

**SERVICE MANUAL**  
**DIGITAL STORAGE +**  
**100MHz OSCILLOSCOPE**  
MODEL **COM 7101A**  
**100MHz OSCILLOSCOPE**  
MODEL **COM 7100A**



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3-1-176, SHINRAHOCHO-ITASASHI, YAMAGUCHI 750, JAPAN





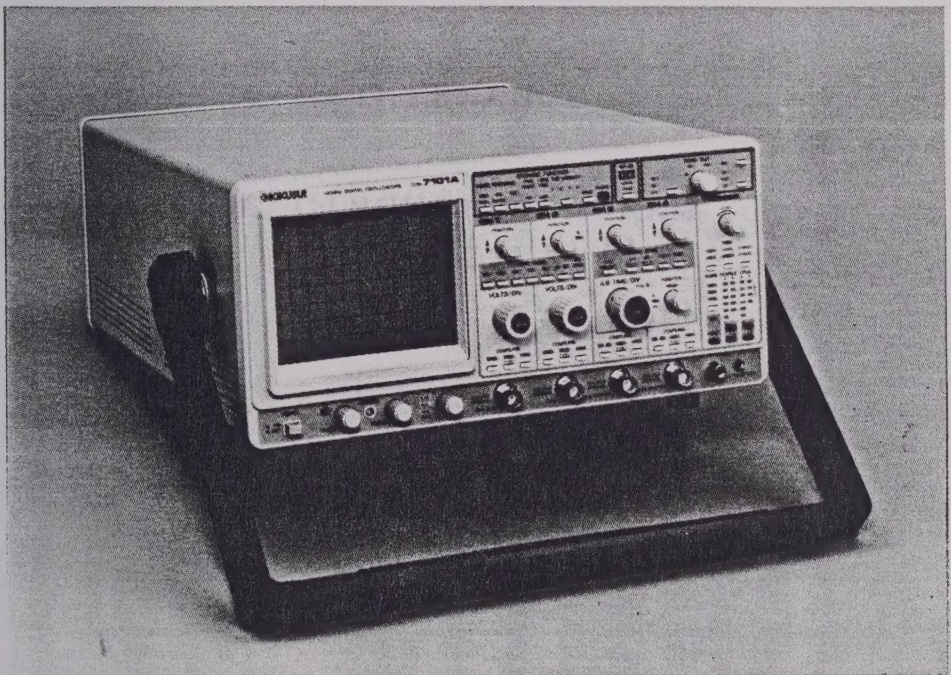
# SERVICE MANUAL

DIGITAL STORAGE +  
100MHz OSCILLOSCOPE

COM 7101A

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COM 7100A



First Edition First Printing March 1988

Parts No. Z1-512-371

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## SECTION 1

### GENERAL





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## 1-1. Description

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## 1-2. Features

### 1-2-1 Common Features of COM7101A/COM7100A

#### (1) CRT display

All information concerning measurement together with the waveform of the signal being measured, are displayed on the CRT. The displayed items include the various functions, level display mode, and timebase sweep speed and delay time, together with the measured values obtained using the cursor lines, and the measured values obtained from the internal digital voltmeter and frequency counter.

#### (2) 4 channel display

The oscilloscope employs a multi-mode select system which permits any combination of the four channels to be selected. All of the four channels provide the specified minimum frequency range either as the BNC input for example or at the probe tips.

#### (3) Cursor function

The two cursors displayed on the CRT permit measurement of voltage difference, time difference, and phase difference. In addition, the results of measurement are digitally displayed on the CRT.

When the tracking mode is activated, the two cursors can be moved while maintaining a constant distance between them.

#### (4) Digital voltmeter and frequency counter functions

The oscilloscope contains a digital voltmeter and frequency counter. The digital voltmeter is a 3-1/2 digit auto-range digital voltmeter which measures the DC, AC RMS, or peak-to-peak voltage of the signal applied to the input terminal of channel 1. The frequency counter is a 3-digit auto-range counter which measures the frequency of the trigger signal selected by the trigger source switch. The measured values are displayed on the CRT.





# 1. GENERAL

## 1-1. Description

The COM7101A/7100A have a frequency bandwidth of between DC and 100MHz, a maximum sensitivity of 1mV/DIV, and a maximum sweep speed of 2ns/DIV. In addition, four vertical and horizontal cursors are available to permit a multi-function CRT readout function.

Particularly, the COM7101A is provided with a digital storage function having a maximum sampling speed of 20ns, enabling instantaneously decaying events to be memorized.

The COM7101A is also provided with a GP-IB function, enabling data held by the digital storage function or CRT readout function to be sent to a computer or other device.

## 1-2. Features

### 1-2-1 Common Features of COM7101A/COM7100A

#### (1) CRT readout

All information concerning measurement together with the waveform of the signal being measured, are displayed on the CRT. The displayed items include the vertical sensitivity, input coupling mode, and timebase sweep speed and delay time, together with the measured values obtained using the cursor lines, and the measured values obtained from the internal digital voltmeter and frequency counter.

#### (2) 4-channel display

The oscilloscope employs a multi-mode select system which permits any combination of the four channels to be selected. All of the four channels provide the specified highest frequency range either at the BNC input terminals or at the probe tips.

#### (3) Cursor function

The two cursors displayed on the CRT permit measurement of voltage difference, time difference, and phase difference. In addition, the results of measurement are digitally displayed on the CRT.

When the tracking mode is activated, the two cursors can be moved while maintaining a constant distance between them.

#### (4) Digital voltmeter and frequency counter functions

The Oscilloscope contains a digital voltmeter and frequency counter. The digital voltmeter is a 3-1/2 digit auto-range digital multimeter which measures the DC, AC RMS, or peak-to-peak voltage of the signal applied to the input terminal of channel 1. The frequency counter is a 4-digit auto-range counter which measures the frequency of the trigger signal selected by the trigger source switch. The measured values are displayed on the CRT.

(5) Extensive use of ICs and self calibration function

A large number of newly developed ICs are employed in the main circuits of the oscilloscope, thereby minimizing the number of discrete components. As a result, reliability and maintainability are improved. The circuits are self-calibrating, ensuring reliable measurement.

(6) Memory for panel setting

All data for panel setting is stored in the internal memory of the oscilloscope and is not destroyed even when the power is turned off. When the power switch is turned on again, the panel setting is automatically restored.

(7) Programmable functions

By using the RC01-COM remote controller in combination with the oscilloscope, up to 100 different panel settings can be memorized and recalled by a simple pushbutton operation.

(8) Requirement line voltage

Both the COM7101A/COM7100A operate on any line voltage within a range of 90 to 250 VAC without requiring any switching procedure.

(9) Automatic triggering level control, requiring no manual adjustment

(10) 4-channel alternate triggering, allowing input signals of different frequencies to be triggered

(11) A TV synchronizing separator for TV.V or TV.H

(12) A linear focus circuit, requiring no manual focus adjustment each time intensity is varied

(13) 3-channel X-Y operation

### 1-2-2 Features of COM7101A

(1) Sampling rate of up to 50MS/sec

The maximum sampling rate is 50MS/sec and the vertical resolution is 8 bits, allowing to capture one-shot phenomena of up to 20MHz.

(2) Digitizing of periodic signals up to 100MHz

Periodic signals of up to 100MHz can be captured by equivalent sampling. the equivalent sampling rate in this case is as high as 10 GS/sec.

(3) Envelope mode for detecting one-shot glitches of down to 20ns

The oscilloscope has a peak value detector circuit which is able to capture periodic pulses of as narrow as 20ns within one sampling period, and to display the maximum and minimum values. This circuit can thus detect pulses of very short duration which occur in slowly changing phenomena and, even when the frequency of the input signal has become higher than one-half of the sampling frequency, aliasing that may cause measuring error can be identified.

(4) Reference memory for storing up to four waveforms

In addition to the display memory, the storage section has a reference memory for up to four waveforms which can be arbitrarily re-written. The reference memory is internally backed up, enabling the stored data to be maintained for a long period.

(5) Other

Various convenient functions are realized with the digital storage, such as pretriggering for viewing the signal waveform preceding the trigger point, interpolation which is convenient for measuring high-speed one-shot phenomena, expansion of time base up to 100 times for stored signal magnification, roll mode which is convenient for monitoring low-speed continuous signals, and delayed magnification which allows high-speed sampling of any portion of a signal sampled at a slow rate.

(6) GP-IB interface functions

Waveform data and front panel setting informations can be transferred to computer in the storage mode, enabling the oscilloscope to be used as a fully programmable digital storage instrument.





# **SECTION 2**

## **SPECIFICATION**

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## 2. SPECIFICATION

### 2-1. Vertical Axis

| Item                           | Specification                                                                                                                                     | Remarks                                       |
|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| CH1, CH2                       |                                                                                                                                                   |                                               |
| Deflection factor              | 1mV / DIV to 5V / DIV                                                                                                                             | 1-2-5 sequence, 12 settings                   |
| Accuracy                       | 5mV / DIV to 5V / DIV : $\pm 2\%$<br>1mV / DIV, 2mV / DIV : $\pm 4\%$                                                                             | 15 to 35°C, 1kHz,<br>4 to 5 DIV reference     |
| Frequency bandwidth            | DC to 100MHz within $-3\text{dB}$<br>DC to 30MHz within $-3\text{dB}$<br>(1mV / DIV, 2mV / DIV)<br>Lower limit frequency<br>of AC coupling : 10Hz | 50kHz 8 DIV reference<br>COM7101A : REAL MODE |
| Vriable Factor                 | Continuously variable attenuation to 1/2.5<br>or less of set value                                                                                |                                               |
| Input impedance                | 1M $\Omega$ $\pm 1\%$ , 20PF $\pm 3\text{PF}$                                                                                                     |                                               |
| CH3, CH4                       |                                                                                                                                                   |                                               |
| Deflection factor              | 0.1V / DIV, 0.5V / DIV                                                                                                                            | 2 settings                                    |
| Accuracy                       | $\pm 5\%$                                                                                                                                         | 15 to 35°C 1 kHz,<br>4 to 5 DIV reference     |
| Frequency bandwidth            | DC to 100MHz within $-3\text{dB}$<br>Lower limit of AC coupling : 10Hz                                                                            | 50kHz 8 DIV reference<br>COM7101A : REAL MODE |
| Input impedance                | 1M $\Omega$ $\pm 1\%$ , 20PF $\pm 3\text{PF}$                                                                                                     |                                               |
| Maximum safe input voltage     | 400V peak (DC + AC peak)                                                                                                                          | AC : 1kHz max                                 |
| Input coupling                 | AC, GND, DC                                                                                                                                       |                                               |
| Rise time                      | Approx. 3.5ns ;<br>Approx. 11.7ns (1mV / DIV, 2mV / DIV)                                                                                          | Theoretic values<br>COM7101A : REAL MODE      |
| Channel modes                  | CH1, ADD (CH1 + CH2), CH2, CH3, CH4<br>Any combination of the above.<br>X-Y display with CH1 as X and any or all of<br>CH2, CH3 and CH4 as Y.     |                                               |
| Time Difference Among Channels | $\pm 500\text{ps}$ (of all channels)                                                                                                              | Exept 1mV / DIV,<br>2mV / DIV ranges          |
| Signal delay time              | Approx. 40ns                                                                                                                                      |                                               |
| CHOP frequency                 | Approx. 1MHz                                                                                                                                      |                                               |
| Bandwidth limiter              | 20MHz $\pm 5\text{MHz}$ within $-3\text{dB}$                                                                                                      |                                               |
| Polarity select                | For CH2 only                                                                                                                                      |                                               |
| CH1 Signal output              | Open : Approx, 50mV/DIV<br>Terminated (50 $\Omega$ ): Approx, 25mV/DIV<br><br>Freq.band width : DC to 100MHz<br>within $-3\text{dB}$              |                                               |

## 2-2. Triggering

| Item                     | Specification                                                                                                                                                                                                                                                                                                                              | Remarks                                                                                                   |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>A trigger</b>         |                                                                                                                                                                                                                                                                                                                                            |                                                                                                           |
| Signal                   | CH1, CH2, CH3, CH4, LINE, and V-MODE (In the V-MODE, channels which normally operate in the VERT modes are used as signal sources. In the ADD mode, CH1 is used as a signal source. In the CHOP mode or AUTO LEVEL mode, the leftmost of the operating channels indicated by the VERT mode lamps on the panel is used as a signal source.) | V-MODE is effective in the ALT SWEEP mode or SINGLE SWEEP mode, or when the AUTO LEVEL mode is cancelled. |
| Coupling                 | AC, LF REJ, HF REJ, DC, TV-V, TV-H                                                                                                                                                                                                                                                                                                         |                                                                                                           |
| Polarity                 | + or -                                                                                                                                                                                                                                                                                                                                     |                                                                                                           |
| Sensitivity              | DC to 10MHz : 0.4 DIV<br>DC to 100MHz : 1.5 DIV<br>TV-V, TV-H : 1.0 DIV<br><br>AC : Attenuates signal components of 10 Hz and lower<br>LF-REJ : Attenuates signal components of 50kHz and lower<br>HF-REJ : Attenuates signal components of 50kHz and higher                                                                               |                                                                                                           |
| AUTO LEVEL               | Add 0.5 DIV to above values.                                                                                                                                                                                                                                                                                                               | For sinusoidal waves                                                                                      |
| Modes                    | AUTO : When no triggering signal is applied, sweep runs automatically.<br><br>NORM : When triggering signal is lost, trace disappears, and sweep goes into READY state.<br><br>SINGL : When triggering signal is applied, sweep runs only once.<br>When RESET key is pressed, sweep is reset to READY state.<br>And ready LED lights.      | COM7101A : REAL MODE                                                                                      |
| <b>B trigger</b>         |                                                                                                                                                                                                                                                                                                                                            |                                                                                                           |
| Triggering signal source | CH1, CH2, CH3, CH4, and V-MODE (In the V-MODE, channels which normally operate in the VERT modes are used as signal sources. In the ADD mode, CH1 is used as a signal source. In the CHOP mode or AUTO LEVEL mode, the leftmost of the operating channels indicated by the VERT mode lamps on the panel is used as a signal source.)       | V-MODE is effective in ALT SWEEP mode or SINGLE SWEEP mode or when AUTO LEVEL mode is cancelled.          |
| Coupling                 | AC, LF REJ, HF REJ, DC                                                                                                                                                                                                                                                                                                                     |                                                                                                           |
| Polarity                 | + and -                                                                                                                                                                                                                                                                                                                                    |                                                                                                           |
| Sensitivity              | DC to 10MHz : 0.4 DIV<br>DC to 100MHz : 1.5 DIV<br>AC : Attenuates signal components of 10 Hz and lower<br>LF REJ : Attenuates signal components of 50 kHz and lower<br>HF REJ : Attenuates signal components of 50 kHz and above                                                                                                          |                                                                                                           |
| AUTO LEVEL               | Add 0.5 DIV to above value.                                                                                                                                                                                                                                                                                                                | For sinusoidal waves                                                                                      |

2-3. Horizontal Axis

| Item                                  | Specification                                                                                                                                        | Remarks                                                          |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| A sweep                               |                                                                                                                                                      |                                                                  |
| Sweep speed                           | COM7100A<br>20ns / DIV to 0.5s / DIV<br>COM7101A<br>REAL : 20ns / DIV to 0.5s / DIV<br>STORAGE : 20ns / DIV to 5s / DIV                              | 1-2-5 sequence                                                   |
| Sweep error                           | Within $\pm 2\%$                                                                                                                                     | 15 to 35°C ; Accuracy for 8 DIV<br>at center of CRT              |
| Sweep<br>vaariable                    | Sweep speed can be increased to at least 2.5<br>times set value.                                                                                     | COM7101A : REAL MODE                                             |
| Variable<br>hold-off                  | Provided                                                                                                                                             | COM7101A : REAL MODE                                             |
| B sweep                               |                                                                                                                                                      |                                                                  |
| Sweep speed                           | COM7100A<br>20ns / DIV to 0.5s / DIV<br>COM7101A<br>REAL : 20ns / DIV to 0.5s / DIV<br>STORAGE : 20ns / DIV to 50ms / DIV                            | 1-2-5 sequence                                                   |
| Accuracy                              | within $\pm 2\%$                                                                                                                                     | 15 to 35°C ; Accuracy for 8 DIV<br>at center of CRT              |
| Delayed sweep                         |                                                                                                                                                      |                                                                  |
| Type of sweep                         | Continuous delay, triggered delay                                                                                                                    |                                                                  |
| Delay jitter                          | Less than 1 / 10,000                                                                                                                                 |                                                                  |
| Sweep<br>magnification                | 10 times<br>Maximum sweep speed : 2ns / DIV                                                                                                          | In ALT mode, B sweep alone is<br>magnified.                      |
| Accuracy of<br>sweep<br>magnification | COM7101A<br>5ns / DIV to 0.5s / DIV : $\pm 4\%$<br>2ns / DIV : $\pm 8\%$<br>COM7100A<br>5ns / DIV to 50ms / DIV : $\pm 4\%$<br>2ns / DIV : $\pm 8\%$ | 15 to 35°C ; Accuracy for 8 DIV<br>at center of CRT              |
| X-Y operation                         |                                                                                                                                                      | COM7101A : REAL MODE                                             |
| X-Y operation                         | X axis : CH1<br>Y axis : CH2, CH3, CH4<br>(X-Y operation of up to 3 channels)                                                                        | Y axis : CHOP Operation                                          |
| Deflection<br>factor                  | Identical to those of CH1, CH2, CH3 and<br>CH4                                                                                                       |                                                                  |
| Accuracy                              | X axis : $\pm 3\%$ (5mV to 5V / DIV)<br>$\pm 5\%$ (1mV / DIV, 2mV / DIV)<br>Y axis : $\pm 2\%$ (CH2), $\pm 5\%$ (CH3, 4)                             | 15 to 35°C, 1kHz, 4 to 5 DIV<br>reference                        |
| Frequency<br>bandwidth                | DC to 2MHz within -3dB                                                                                                                               | X axis : For CH1 ;<br>Y axis : Identical to CH2,<br>CH3, and CH4 |
| X-Y phase<br>difference               | Within 3° between DC and 100kHz                                                                                                                      |                                                                  |



## 2-4. CRT Readout

| Item               | Specification                                                                                                                                                                      | Remarks                                                                                                                               |
|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Setting display    |                                                                                                                                                                                    |                                                                                                                                       |
| Vertical axis      | CH1, CH2, CH3, and CH4 DEFLECTION FACTOR and COUPLING ; Display when 10 : 1 probe is used ; CH1 and CH2 UNCAL status ; BWL                                                         | BWL = Band Width Limiter                                                                                                              |
| Sweep              | A and B sweep speed.<br>A sweep UNCAL status ;<br>HOLDOFF ; Delay time                                                                                                             |                                                                                                                                       |
| Cursor             | $\Delta$ REF cursor and $\Delta$ cursor<br>$\Delta V$ , voltage ratio, $\Delta T$ , $1 / \Delta T$ , and time ratio<br>Phase difference                                            |                                                                                                                                       |
| Others             | Frequency counter and DVM reading                                                                                                                                                  |                                                                                                                                       |
| Storage            | Display of DEFLECTION FACTOR and coupling modes of reference memory<br>Reference memory sweep speed : Predelay trigger point ; Magnification point ; Delay start point ; View time | COM7101A : STORAGE MODE                                                                                                               |
| DLY                | Delay time                                                                                                                                                                         |                                                                                                                                       |
| Delay time range ; | 0.5 to 10.00 times A sweep setting of highest sweep speed range to 0.5s / DIV range                                                                                                |                                                                                                                                       |
| Accuracy           | Within $\pm 2\%$                                                                                                                                                                   |                                                                                                                                       |
| $\Delta V$         | Voltage between $\Delta$ RFF cursor and $\Delta$ cursor is measured and displayed.                                                                                                 | In CH2 SINGLE SWEEP mode or in CH2 and CH3 / CH4 channel modes, DEFLECTION FACTOR is that of CH2 ; in other cases, it is that of CH1. |
| Measuring range    | $\pm 3.6$ DIV from center of CRT                                                                                                                                                   | Minimum guaranteed value                                                                                                              |
| Accuracy           | Within $\pm 3\%$                                                                                                                                                                   |                                                                                                                                       |
| Voltage ratio      | Displays the ratio of voltage between $\Delta$ RFF cursor and $\Delta$ cursor with respect to 5 DIV on CRT as reference (100%).                                                    | For $\Delta V$ measurement, GAIN VARIABLE is displayed in UNCAL status.                                                               |
| Measuring range    | $\pm 3.6$ DIV from center of CRT                                                                                                                                                   | Minimum guarantee value                                                                                                               |
| Accuracy           | Within $\pm 3\%$                                                                                                                                                                   |                                                                                                                                       |
| $\Delta T$         | Time between $\Delta$ RFF cursor and $\Delta$ cursor is displayed.                                                                                                                 | Minimum guaranteed value                                                                                                              |
| Measuring range    | $\pm 4.6$ DIV from center of CRT                                                                                                                                                   |                                                                                                                                       |
| Accuracy           | Within $\pm 3\%$                                                                                                                                                                   |                                                                                                                                       |

| Item             | Specification                                                                                                                                         | Remarks                                                                                                  |
|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|
| 1 / $\Delta T$   | Reciprocal (frequency) of $\Delta T$ is displayed.                                                                                                    |                                                                                                          |
| Time ratio       | Displays the ratio of time interval between $\Delta RFF$ cursor and $\Delta$ cursor with respect to 5 DIV or CRT as reference (100%).                 | For $\Delta T$ measurement, SWEEP VARIABLE is displayed in UNCAL status.                                 |
| Measuring range  | $\pm 4.6$ DIV from center of CRT                                                                                                                      | Minimum guaranteed value                                                                                 |
| Accuracy         | Within $\pm 3\%$                                                                                                                                      |                                                                                                          |
| Phase difference | Displays in degree the phase difference between $\Delta REF$ cursor and $\Delta$ cursor with respect to 5 DIV on CRT as reference (360 degrees).      | For 1 / $\Delta T$ measurement, SWEEP VARIABLE is displayed in UNCAL status.                             |
| Measuring range  | $\pm 4.6$ DIV from center of CRT                                                                                                                      | Minimum guarantee value                                                                                  |
| Accuracy         | Within $\pm 3\%$                                                                                                                                      |                                                                                                          |
| $\Delta$ Delay   | Measures $\Delta T$ or 1 / $\Delta T$ by using B sweep instead of $\Delta REF$ cursor and $\Delta$ cursor.                                            | Operates in ALT sweep and B sweep modes at the same time.                                                |
| Measuring range  | 3.6 DIV from center of CRT                                                                                                                            | Minimum guarantee value                                                                                  |
| Accuracy         | Within $\pm 2\%$ (excluding 0.5 DIV from left hand end of CRT)                                                                                        |                                                                                                          |
| DVM              | Displays using 3-1/2 digits in auto-range system the CH1 input for up to $\pm 10$ DIV on CRT (AC voltage, DC voltage, p-p voltage)                    | COM7101A : Excluding storage mode                                                                        |
| AC measuring     | Measures AC voltage as RMS value between 20Hz and 100kHz accuracy ; within $\pm 4\%$                                                                  | Tcal $\pm 5\%$<br>Tcal = Self Calibration Temperature (20~30°C) at center of CRT                         |
| DC measuring     | Measures DC voltage accuracy ; within $\pm 3\%$                                                                                                       | Tcal $\pm 5\%$<br>Tcal = Self Calibration Temperature (20~30°C) at center of CRT                         |
| p-p measuring    | Measures peak-to-peak voltage of AC component between 20Hz and 10MHz ;<br>accuracy 20Hz ~ 5MHz ; within $\pm 5\%$<br>5MHz ~ 10MHz ; within $\pm 10\%$ | Tcal $\pm 5\%$<br>Tcal = Self Calibration Temperature (20~30°C) at center of CRT                         |
| FREQUENCY        | Measures frequency of input channel signal selected by TRIG SOURCE switch 4-digit display, auto-range                                                 | Operates simultaneously with DVM. Not effective when two or more triggering source signals are selected. |
| Measuring rang   | 1.0Hz to 100MHz                                                                                                                                       |                                                                                                          |
| Error            | $\pm 0.1\%$                                                                                                                                           |                                                                                                          |

## 2-5. Storage Mode (COM7101A only)

| Item                        | Specification                                                                                                                                                                                                                                                                   | Remarks                                                                                         |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Vertical axis resolution    | 8 bits (25 points / DIV)                                                                                                                                                                                                                                                        |                                                                                                 |
| Horizontal axis resolution  | 10 bits (100 points / DIV)                                                                                                                                                                                                                                                      |                                                                                                 |
| Sampling rate ;             | In single channel mode or multi-channel ALT mode : 20 samples / sec to 50M samples / sec<br>In CHOP or ALT mode : 20 samples / sec to 20M samples / sec                                                                                                                         |                                                                                                 |
| Accuracy                    | $\pm 0.02\%$                                                                                                                                                                                                                                                                    |                                                                                                 |
| Effective storage frequency | 100MHz (repeat mode) :<br>For 1 $\mu$ s / DIV to 20ns / DIV range (in CHOP mode, 2 $\mu$ s / DIV to 10ns / DIV range), and periodic signals.<br>20MHz : For 2 $\mu$ s / DIV to 20ns / DIV range excluding CHOP mode.<br>8MHz : 5 $\mu$ s DIV to 10ns / DIV, in SINGLE SWEEP     | With Sine Interpolation effective storage frequency band is 100MHz : - 3dB max in vertical axis |
| Effective rise time         | 3.5ns max (repeat mode) :<br>1 $\mu$ s / DIV to 20ns / DIV range (2 $\mu$ s / DIV to 20ns / DIV range for CHOP mode), and periodic signals.<br>32ns max : 2 $\mu$ s / DIV to 20ns / DIV range, excluding CHOP mode.<br>80 ns max : 5 $\mu$ s DIV to 10ns / DIV, in SINGLE SWEEP | With pulse interpolation                                                                        |
| Operating modes             | SINGLE SWEEP : CH1, CH2, CH3, CH4<br>ALT : Any combination of CH1 through CH4<br>CHOP : CH1 and CH2                                                                                                                                                                             |                                                                                                 |
| Repecat mode                | For single channel or ALT sweep : 1 $\mu$ s / DIV to 20ns / DIV<br>For CHOP : 2 $\mu$ s / DIV to 20ns / DIV                                                                                                                                                                     | Except for SINGLE SWEEP mode in random equivalent time sampling                                 |
| ROLL mode                   | 5s / DIV to 0.1s / DIV                                                                                                                                                                                                                                                          | For single channel mode or 2-channel mode                                                       |
| ENVELOPE mode               | Operating ranges :<br>50ms / DIV to 10 $\mu$ s / DIV                                                                                                                                                                                                                            |                                                                                                 |
| Waveform magnification      | Waveform can be expanded up to $\times 100$ of the timebase setting.<br>Reference position for magnification :<br>0 DIV to 10 DIV in 1-DIV steps, 11 positions<br>Interpolation : Sine or pulse                                                                                 |                                                                                                 |
| Display memory              | (1.024 words per channel) $\times$ 4                                                                                                                                                                                                                                            |                                                                                                 |
| Reference memory            | For 4 waveforms                                                                                                                                                                                                                                                                 |                                                                                                 |
| Pre-triggering              | Trigger point ; 0,2,4,6,8 DIV at CRT                                                                                                                                                                                                                                            | For PAUSE status                                                                                |
| View time                   | 0 to about 10 seconds                                                                                                                                                                                                                                                           | 4 steps                                                                                         |

2-6. GP-IB Interface Functions (COM7101A only)

| Item                                              | Specification                                                                                                                                                                                                                                         | Remarks |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Interface functions<br>(IEEE488-1978)<br>(IEC625) | SH1 : All source handshake<br>AH1 : All acceptor handshake<br>T6 : Talker<br>L3 : Listener<br>SR1 : All service request<br>RL1 : All remote / local<br>PP0 : No parallel poll<br>DC1 : All device clear<br>DT0 : No device trigger<br>C0 : No control |         |
| Programmable functions                            | All functions except VARIABLE, FOCUS, TRACE ROTATION                                                                                                                                                                                                  |         |
| Format                                            | Device commands: ASCII<br>Waveform data : Binary or ASCII (selectable)                                                                                                                                                                                |         |

2-7. Programmable Control Functions (by using RC01-COM in conjunction)

| Item                      | Specification                                         | Remarks                                   |
|---------------------------|-------------------------------------------------------|-------------------------------------------|
| Program steps             | 100 (00 to 99)                                        | Displayed on 7 SEG LED                    |
| Programmable functions    | All functions except INTEN, FOCUS, and TRACE ROTATION | Only models provided with GP-IB interface |
| Program backup            | Provided                                              |                                           |
| External control function | Can be connected to probe selector (PS01-COM)         |                                           |
| Step address output       | BCD code                                              |                                           |

2-8. Z axis

| Item                       | Specification                                                                                                                                   | Remarks                             |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|
| Sensitivity                | Intensity modulation discernible with 3 Vp-p input signal. Negative-going signal for brighter trace and positive-going signal for dimmer trace. |                                     |
| Frequency range            | DC to 10 MHz                                                                                                                                    |                                     |
| Input resistance           | 5 k $\Omega$ $\pm$ 10%                                                                                                                          |                                     |
| Maximum safe input voltage | 50V peak (DC + AC peak)                                                                                                                         | AC components not higher than 1 kHz |



2-9. Signal Outputs

| Item                | Specification                                                                                        | Remarks                    |
|---------------------|------------------------------------------------------------------------------------------------------|----------------------------|
| Sweep signal output | A sweep signal : Approx. 1 Vp-p                                                                      | BNC terminal at rear panel |
| Sweep gate output   | A sweep gate signal output :<br>Approx. 5 Vp-p<br><br>B sweep gate signal output :<br>Approx. 5 Vp-p | BNC terminal at rear panel |

2-10. Calibration Voltage

| Item              | Specification         | Remarks |
|-------------------|-----------------------|---------|
| Waveform          | Positive pulse signal |         |
| Frequency         | 1 kHz $\pm$ 0.1%      |         |
| Output voltage    | 0.5 Vp-p $\pm$ 2%     |         |
| Output resistance | Approx. 2 k $\Omega$  |         |

2-11. Pen Out Signals (COM7101A)

| Item                | Specification                                                                         | Remarks                                                                  |
|---------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| X-Y recorder output | Operates in storage mode                                                              |                                                                          |
| X axis output       | 0.1 V / DIV $\pm$ 10%<br>(Speed automatically varies in response to Y-axis amplitude) | BNC terminal at rear panel<br>(common with sweep signal output terminal) |
| Y axis output       | 0.1 V / DIV $\pm$ 10%                                                                 | BNC terminal at rear panel                                               |
| SYNC output         | TTL level, positive output                                                            | BNC terminal at rear panel<br>(common with A sweep gate terminal)        |

2-12. CRT

| Item             | Specification                                                                                                                                                       | Remarks |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| Cathode-ray tube | 6-inch square screen, with internal white graticule<br>Effective screen area : 8 $\times$ 10 cm<br>(3.15 $\times$ 3.94 in.)<br>Acceleration voltage : Approx. 20 kV |         |

2-13. Power Requirements

| Item              | Specification                                     | Remarks                       |
|-------------------|---------------------------------------------------|-------------------------------|
| Line voltage      | 90V to 250V                                       | No voltage selection required |
| Line frequency    | 48 Hz to 62 Hz                                    |                               |
| Power consumption | COM7100A : Approx. 65W<br>COM7101A : Approx. 103W |                               |

2-14. Ambient Conditions

| Item                    | Specification                                     | Remarks |
|-------------------------|---------------------------------------------------|---------|
| Operating range         | Temperature : 5°C to 40°C ;<br>Humidity : 90% max |         |
| Maximum operating range | Temperature : 0°C to 50°C ;<br>Humidity : 95% max |         |

2-15. Dimensions and Weights

| Item       | Specification                                         | Remarks |
|------------|-------------------------------------------------------|---------|
| Dimensions | 318W×150H×400D (mm)                                   |         |
| Weight     | COM7100A : Approx. 8 kg ;<br>COM7101A : Approx. 10 kg |         |

2-16. Accessories

| Item  | Specification       | Remarks |
|-------|---------------------|---------|
| Probe | P100 - S type × two | 10 : 1  |



# **SECTION 3**

## **CIRCUIT DESCRIPTION**

First Edition First Printing March 1988





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## 3. CIRCUIT DESCRIPTION

### 3.1 BLOCK DIAGRAM

#### 3.1.1 General

COM7101A consists of real time section and storage section.

COM7100A consists of real time section only.

#### 3.1.2 Real time section

Figure 3-1 shows oscilloscope section and Fig. 3-2 shows control section.

Most of mechanical switches used in conventional oscilloscopes are replaced with electronics switches in the COM7000A series. These switches are controlled by digital signals.

And gain, sweep variables, H, V-axis positions are also controlled digitally.

Thus most of the functions can be controlled remotely by GP-IB.

Majority of the circuits are built on HIC (Hybrid Integrated Circuit).

Self-calibration is provided so that V-axis gain, DC-balance and sweep speed are automatically checked and adjusted.

For instance, when the DC-balance to be adjusted.

1. Output voltage of the V-axis is digitized then checked by C.P.U.
2. The C.P.U determine whether the voltage is within the range or not.
3. The C.P.U calculate how much voltage have to be applied to the V-axis amplifier to compensate if the voltage was out of the range.
4. These processes are repeated till the voltage fall into the range.

When the V-axis gain to be adjusted.

1. Set the volt/div at 5 mV/div.
2. Reference voltage of 30.0 mV is applied to the V-axis input.
3. C.P.U determines whether the gain is within the range or not comparing the output voltage and the reference voltage.
4. The C.P.U feeds voltage to where the gain is controlled.

When the sweep speed to be adjusted

1. Read the time between two points where 8 div apart in H-axis.
2. The C.P.U determines that the time is within the range or not.
3. The C.P.U controls the sweep variable circuit till the time falls into the range.

Nearly half of the adjustments are performed automatically.

The control section is handled by main C.P.U (Z80, 8 bit). All the front panel informations are read and made necessary changes by the C.P.U.

The main C.P.U also communicates with the sub-C.P.U in case of COM7100A.





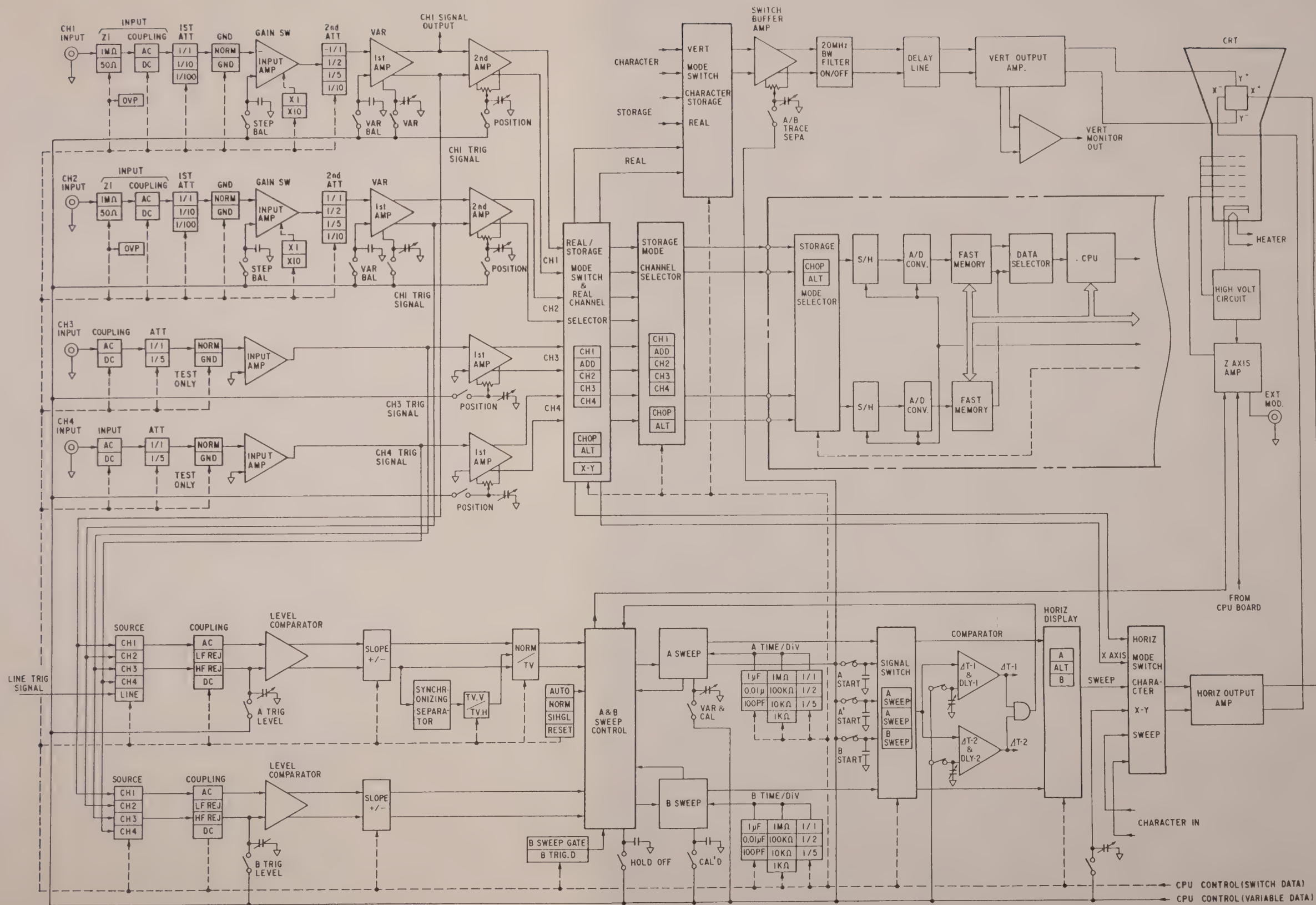


Figure 3-1 Block Diagram (Real Time System, Oscilloscope Section)









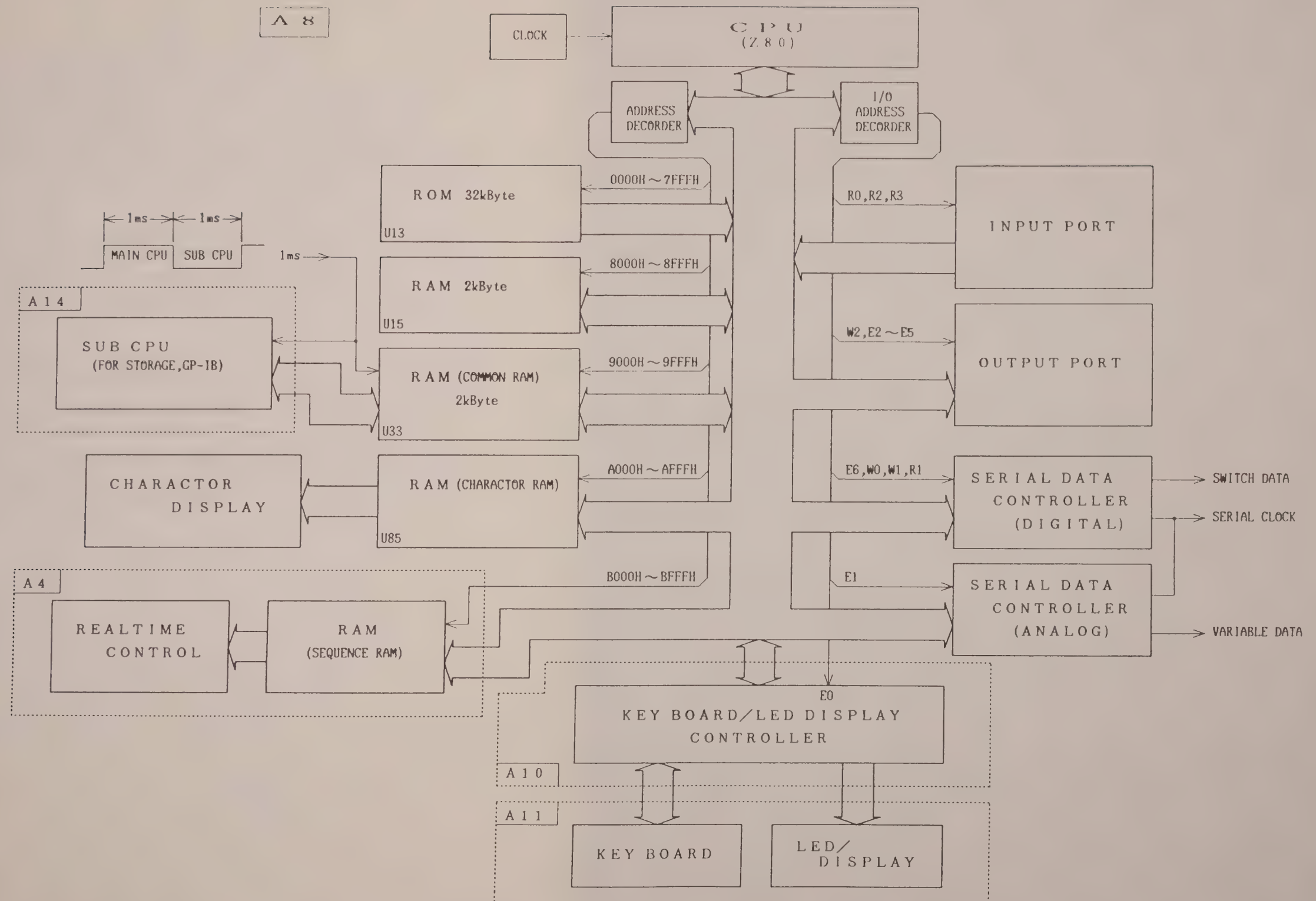


Figure 3-2 Block Diagram (Real Time System, Control Section)



### 3.1.3 Storage section

Block diagram for the storage section is shown in Fig. 3-3.

The storage section consists of analog processing, A/D memory, acquisition control, storage display and sub-C.P.U section.

The analog processing section amplify and convert the impedance of the signal picked-off from the real time section then fed to the A/D memory section. In case of “envelope” mode is selected the signal is routed to “envelope peak hold circuit” then to the A/D memory section.

The A/D memory section consists of sample and hold circuit, A/D converter, high speed memory, address counter, and timing generator. The maximum sampling frequency is 50 MHz. Two A/D converters are used alternately to achieve 50 MHz.

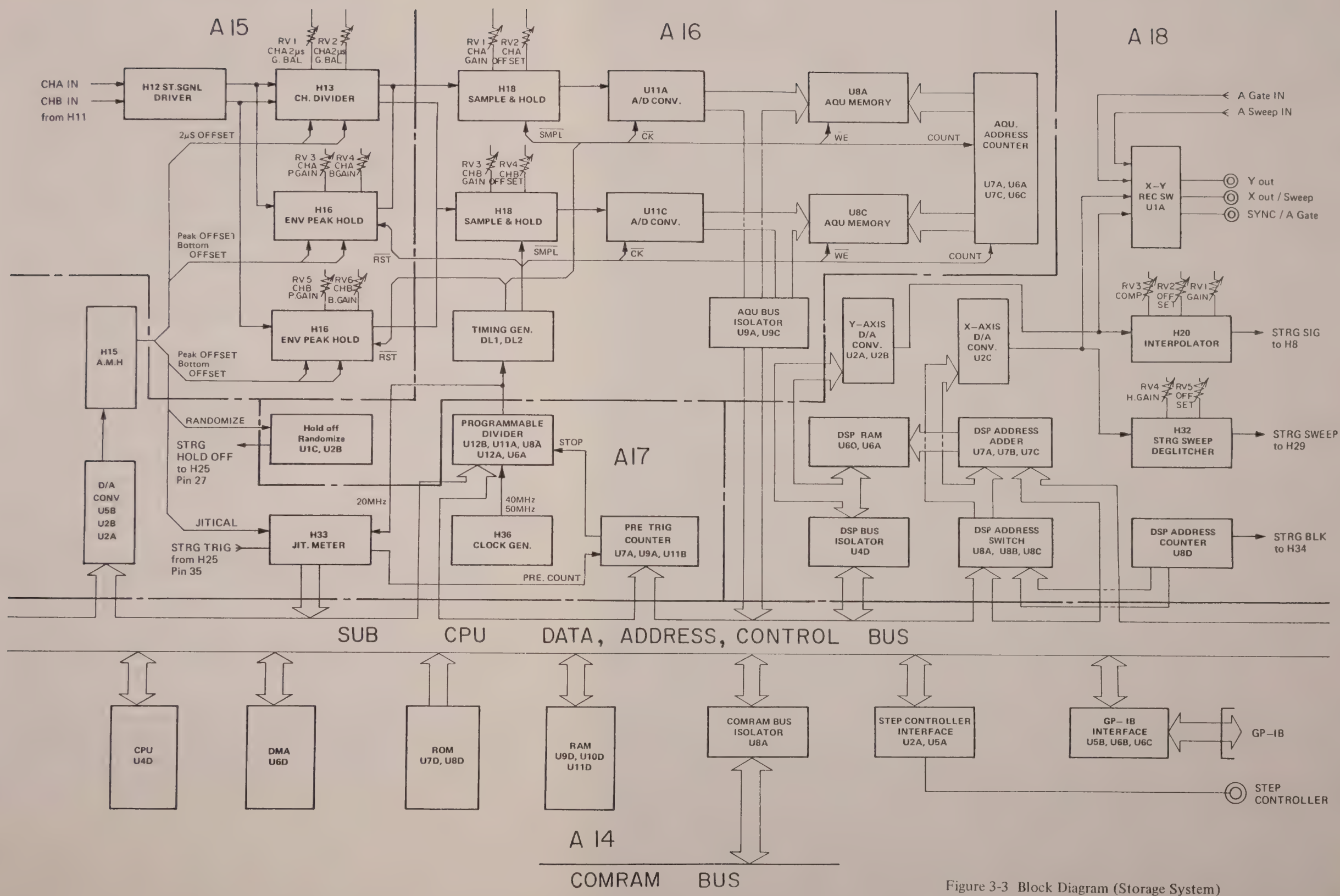
The timing generator produces sequential sampling pulses and random sampling pulses when in “repeat” mode.

The acquisition control section consists of clock generator, programmable divider, jitter meter, pre-trig, counter, analog multiplexer, and D/A converter.

The storage display section consists of display RAM, Y-axis D/A converter display address counter, interpolator, storage deglitcher, and X-Y recorder output circuit.

The sub-C.P.U section employs 8 bit C.P.U (Z80) to manage the storage section. Necessary informations are fed from the main C.P.U through common RAM. Also interface function is provided for step controller or GP-IB.









## 3.2 CIRCUIT DESCRIPTION

### 3.2.1 CRT Section

#### 1) High voltage Generator Circuit (A6 PCB)

High voltage generator circuit comprises DC-DC converter which is called BLOCKING generator.

Approximately 50 kHz sine wave from the BLOCKING generator is stepped up by secondary winding of the high voltage transformer, and rectified to  $-2,100$  V to accelerate the beam. The voltage is fed back to OP AMP via resistor. The OP AMP controls drive transistor of the BLOCKING generator to obtain constant  $-2,100$  V. The secondary voltage is applied to multiplier circuit and used for post acceleration of the CRT beam. Voltage from secondary center tap of the transformer is used for intensity and focus control circuits.

#### 2) Z-axis Circuit (A6 PCB)

Z-axis circuit amplifier comprises HIC. Blanking signal and focus signal are applied to differential AMP, which controls proper focus regardless to the brightness or delay sweep control.

#### 3) Character Generator Circuit (A8-PCB)

Datas (ASCII code) for the characters are fed to character RAM (A8-U85 6116). The datas are then routed to character ROMs (A8-U105 2764) as the address signal. X-axis and Y-axis datas are fed out from the ROMs. These datas are latched and converted to analog signal by D/A converter.

These signals are called as CHR-X and CHR-Y.

#### 4) DVM Circuit (A4 PCB)

By using CH1 2nd ATT (A4-U3 H5) output signal, the DVM circuit measures DC and AC voltage. Both RMS and P-P are measured. True RMS converter measures RMS, and + and - PEAK DETECTOR in HIC and differential OP AMP measures P-P.

### 3.2.2 Vertical Axis Section

#### 1) Attenuator Circuit (A1, A3, A4 PCB)

Attenuator circuit consists of ATT (A1) for CH1 and 2, and ATT (A3) for CH3 and 4.

The ATT (A1) employs semiconductor switches and relays, and comprises 1st ATT of HIC (H3) and 2nd ATT on A4 PCB. The ATT includes input signal attenuation ( $10\text{ mV} \sim 5\text{ V} / \text{DIV}$ , 9 steps), input coupling (AC/DC/GND), and  $\times 10$  MAG circuit for  $1\text{ mV}$  and  $2\text{ mV/DIV}$  sensitivity setting.

ATT (A3) houses two channel in a case, and employs semiconductor switches and relays same as A1. It includes (H4) input signal attenuation (1/1, 1/5, 2 steps), input coupling (AC/DC/GND) and input impedance switching.

## 2) Preamplifier Circuit

There are two types of preamplifiers are used.

One is commonly used on CH1 and CH2, which is providing 1st AMP and 2nd AMP.

Other one for CH3 and CH4 which is providing input AMP and 2nd AMP.

The 1st AMP consists of unbalance to balance converter,  $\times 2$  MAG (when in 5 mV/DIV setting), step balance, and variable gain controls.

The position control, position centering, internal trigger-pickoff and V-axis gain circuits are provided in the 2nd AMP.

The input AMP for CH3 and CH4 consists of impedance converter, and attenuator.

## 3) Switching Circuit

Balanced signals from CH1, 2, 3, 4 and storage circuit are selected by the switching circuit (A4-U20 H8).

Real mode signal, X-Y mode signal, and storage signals are fed out. CH2 INV function is also provided.

## 4) Delay Line Circuit

Delay line circuit comprises delay line driver (A4-U25 H9) and delay line, and delays vertical signal, switches observation signal and character. BEAM FIND and BWL (Band Width Limit) are also provided.

## 5) Final Stage

Final stage comprises HIC (A5-U2 H10), deflector drive transistor (A5-Q2, Q3) and deflector potential detector circuit (A5-U1). Deflector drive transistor, with HIC internal transistor makes cascade amplifier for wide band amplification.

the Deflector potential detector circuit is for data feedback during self-calibration, it detects DC balance of differential amplifier in HIC, applies the potential to A/D converter [D/A converter on A10 (A10-U13)], and feeds back to C.P.U.

### 3.2.3 Trigger Section

#### 1) Trigger Pickoff

Internal trigger signal is picked off from 2nd AMP (A4-U13-U16) of CH1 ~ CH4. It picks off half a differential signal, and feeds the signal to TRIG SOURCE SW circuit (A4-U27) in current mode.

#### 2) Trigger Source and Coupling

TRIG SOURCE SW (A4-U27) selects internal trigger signal obtained from trigger pickoff circuit and line trigger signal as A or B trigger signal. The line trigger signal at primary input voltage of power supply circuit (A12-PC1), is detected by transistor (A12-Q1), isolated by photo-coupler (A12-PC1), impedance converted (A12-Q15), then applied to TRIG SOURCE SW circuit (A4-U27) via mother board.

A trigger signal from TRIG SOURCE SW circuit is applied to TRIG COUPLING circuit (A4-U28) and DC, AC, HF REJECT, or LF REJECT coupling will be selected.

And the output signal is applied to trig level comparator circuit (A4-U30) then shaped to square waveform.

The square waveform is fed to sweep controller circuit (A4-U48).

TRIG LEVEL COMPARATOR circuit output includes a signal 180° differs from SWEEP CONTROLLER output signal in phase, which applied to TV SYNC circuit (A4-U32) to separate TV synch signals (vertical synch signal, horizontal synch signal), and the signal is applied to SWEEP CONTROLLER circuit as TV TRIG signal.

B trigger circuit provides no TV SYNC circuit, and other functions are same as A trigger circuit.

### 3.2.4 Horizontal axis Section

#### 1) Triggering and Sweep (A/B)

Trigger signal from the trigger circuit is applied to the sweep circuit and produces sweep signal. The sweep circuit comprises SWEEP CONTROLLER circuit (A4-U48), A/B SWEEP GEN circuit (A4-U43, A4-U44) mentioned below, and generates 10 ns/DIV maximum sweep signal to 0.5 s/DIV sweep signal. (Sweep signal in STORAGE MODE is generated in other circuit.)

The SWEEP CONTROLLER comprises A and B SWEEP GENERATORS, and controls sweep signal (A/B) synchronization by trigger signal, SWEEP MODE (AUTO, NORM, SINGLE selection), continuous and triggered delay.

#### 2) Sweep Timing Circuit

Sweep timing circuit determines A/B sweep time respectively. This circuit is built in the A/B SWEEP GEN circuit with a Miller integrator circuit and a constant current circuit, and controls sweep signal in accurate timing. Component used in the circuit have better temperature coefficient.

#### 3) X-Y function

The CH1 operates as X-axis and the CH2, 3, and 4 operate as Y-axis. Vert mode SW circuit (A4-U20) controls the vertical mode.

#### 4) Switching Circuit

Horizontal axis switching circuit comprises SWEEP COMP SW circuit (A4-U52 H29) and HORIZ SW & DRIVE AMP circuit (A4-U55 H30).

The SWEEP COMP SW circuit switches A, B sweep signal and sweep signal in the STORAGE mode to panel operation. It has "HORI OUT" to be applied to next stage HORIZ SW & DRIVE AMP circuit, and "COMP OUT" to be applied to DELAY TIME COMP. circuit (A4-U56, H28).

The HORIZ SW & DRIVE AMP circuit switches sweep signal (A, B sweep signal and sweep signal during STORAGE MODE), X-axis signal for X-Y function, and character X-axis signal. Also controls  $\times 10$  MAG and BEAM FIND function.

#### 5) Final Stage

Final stage is designed with HORIZ FINAL AMP (A5-U3 H31). The circuit is non-saturation type amplifier which employs Active Load and has good linearity to higher amplitude: double high frequency injection is provided to improve rise and fall time. Also composite horizontal axis signal (A5-Q4 ~ Q6) is applied to FOCUS DRIVE circuit (A6-U601 H31) to improve corner image of the CRT.



3.2.5 Storage Section

1) Input Signal and Channel Divider

Two A/D converters are used to facilitate 50 MHz/Sampling. And two A/D input signals, CHA and CHB, are routed from VERT MODE SW circuit.

Table 3-1 shows function of the VERT MODE SW circuit in the STORAGE mode.

| SETTING      |      | OUTPUT  |         | SIGNALS FOR DIGITIZING |                                                               |
|--------------|------|---------|---------|------------------------|---------------------------------------------------------------|
|              |      | CHA     | CHB     |                        |                                                               |
| Single trace | CH1  | CH1     | CH2/CH4 | CHA signal.            |                                                               |
|              | CH2  | CH1/CH3 | CH2     | CHB signal.            |                                                               |
|              | CH3  | CH3     | CH2/CH4 | CHA signal.            |                                                               |
|              | CH4  | CH1/CH3 | CH4     | CHB signal.            |                                                               |
| Dual trace   | ALT  | CH1/CH2 | CH1     | CH2                    | CHA/CHB signals alternately.                                  |
|              |      | CH1/CH3 | CH1/CH3 | CH2/CH4                | CHA signals (CH1 and CH3) alternately.                        |
|              |      | CH1/CH4 | CH1     | CH4                    | CHA/CHB alternately.                                          |
|              |      | CH2/CH3 | CH3     | CH2                    | CHA/CHB signals alternately.                                  |
|              |      | CH2/CH4 | CH1/CH3 | CH2/CH4                | CHB signals (CH2 and CH4) alternately.                        |
|              |      | CH3/CH4 | CH3     | CH4                    | CHA/CHB alternately.                                          |
|              | CHOP | CH1/CH2 | CH1     | CH2                    | CHA/CHB signals.<br>Unable to select CH3 or CH4 in CHOP mode. |

Table 3-1 Function of VERT MODE SW circuit in STORAGE mode.

Output signal of the VERT MODE SW circuit is applied to the ST SIGNAL BUFFER circuit (A4-U26 H11), then converted to voltage from current, then routed to the ANALOG PROCESSING BOARD (A15).

The ANALOG PROCESSING BOARD routes the OUTPUT SIGNAL to the GND REF circuit (A15-CR1 ~ CR8, Q3, Q4).

The GND REF circuit switches its input signal between ground level and the output signal from the VERT MODE SW circuit when in the SELF CAL MODE.

The output of the GND REF circuit is applied to the STORAGE SIGNAL DRIVE circuit (A15-H12) for amplification and impedance conversion.

The STORAGE SIGNAL DRIVER output signal is fed to the CHANNEL DIVIDER circuit (A15-U6 H13). When the ENVELOPE MODE is not selected, Table 3-2 shows function of the CHANNEL DIVIDER circuit.

| SETTING      |         | INPUT             |                 | OUTPUT            |                   | SIGNAL FOR DIGITIZING           |                                  |
|--------------|---------|-------------------|-----------------|-------------------|-------------------|---------------------------------|----------------------------------|
|              |         | CHA<br>(20-21pin) | CHB<br>(2-3pin) | CHA<br>(32-33pin) | CHB<br>(34-35pin) |                                 |                                  |
| Single trace | CH1     | CH1               | CH2/CH4         | CH1               | CH1               |                                 |                                  |
|              | CH2     | CH1/CH3           | CH2             | CH2               | CH2               |                                 |                                  |
|              | CH3     | CH3               | CH2/CH4         | CH3               | CH3               |                                 |                                  |
|              | CH4     | CH1/CH3           | CH4             | CH4               | CH4               |                                 |                                  |
| Dual trace   | ALT     | CH1/CH2           | CH1             | CH2               | CH1/CH2           | CH1/CH2                         | CH1 and CH2 signals alternately. |
|              |         | CH1/CH3           | CH1/CH3         | CH2/CH4           | CH1/CH3           | CH1/CH3                         | CH1 and CH3 signals alternately. |
|              |         | CH1/CH4           | CH1             | CH4               | CH1/CH4           | CH1/CH4                         | CH1 and CH4 signals alternately. |
|              |         | CH2/CH3           | CH3             | CH2               | CH2/CH3           | CH2/CH3                         | CH2 and CH3 signals alternately. |
|              |         | CH2/CH4           | CH1/CH3         | CH2/CH4           | CH2/CH4           | CH2/CH4                         | CH2 and CH4 signals alternately. |
|              | CH3/CH4 | CH3               | CH4             | CH3/CH4           | CH3/CH4           | CH3 and CH4 signal alternately. |                                  |
| CHOP         | CH1/CH2 | CH1               | CH2             | CH1               | CH2               |                                 |                                  |

Table 3-2 Function of CHANNEL DIVIDER circuit

Thus the signals are divided and routed to the A/D, and memory board (A16).

2) Peak Hold Circuit

Peak Hold circuit functions when in the ENVELOPE MODE, and when the ENVELOPE MODE is not selected, output of this circuit is off. When in the ENVELOPE MODE, input signal is fed to the ENV PEAK HOLD circuit (A15-U7 U8 H16), then + and – PEAK are detected.

U8 detects CHA (CH1/CH3), and U7 detects CH3 (CH2/CH4), and holds the value until next sampling. Output of the ENV PEAK HOLD circuit is connected in parallel to output of the CHANNEL DIVIDER circuit.

3) Sample Hold and High Speed A/D Converter

A pair of signals routed from analog processing board (A15) are fed to a pair of differential to single signal converters (A160Q1 ~ Q4) on the A/D and memory board (A16).

The signal then routed to a pair of SAMPLE and HOLD circuits (A16-U12A, U12C H18). The clock frequency is upto 25 MHz.

The signals are digitized by a pair of 8 bit A/D converters (A16-U11A, U11C UVC3120).

The sampling pulses are slightly delayed by delay cables (A16-DL1, DL2) and the associated circuit.

This delay circuit feed various delayed signals to MEMORY CIRCUIT (A16-U8A, U8C TMM2018-35), address counter circuit (A16-U6A, U6C, U7A, U7C, F269, F169) and so on.

#### 4) High speed Memory and Address Counter

High speed devices are utilized to meet the high speed operation for following circuitry;

memory (A16-U8A, U18C TMM2018-35) data bus buffer (A16-U10A, U10C F541) address counter (A16-U6A, U6C, U7A, U7C, F269, F169).

#### 5) Random Sampling

Random sampling technic is used for the REPEAT MODE.

The input signal is sampled in random manner and repeated over 1000 times to fill the memory.

The sampling timing is produced by jitter interval meter circuit (A17-U3B H33).

The circuit consists of charging and discharging circuit with counter and the time constants of these circuit are managed very tightly.

#### 6) Roll Function

Roll mode is executed by the program.

The latest data captured is placed in the lead address and all data in the memory are shifted one address to the end.

#### 7) Linear and Sine Interpolation

Linear INTERPOLATION circuit (A18-U1B H20) is located next to vertical axis D/A convertor (A18-U2A DAC08EN) of STORAGE DISPLAY PCB (A18).

the Interpolation is also called dot-join circuit, and it joins D/A converted vertical axis data with straight line. It detects potential across two points and integrates it and adds the value to the head data. When the integration finished, it results in same value of the hind data.

The STORAGE SWEEP DEGLITCHER circuit (A18-U1C, H32) located next to horizontal D/A convertor (A18-U2C HA17012PB) eliminate conversion noise and joins horizontal axis steps with straight line.

Noises are eliminated by the SAMPLE and HOLD circuit and the step voltage is converted to slope by the integrator.

At least 2.5 datas per cycle are necessary to complete the calculation of the locus for  $360^\circ$ .

3.2.6 CPU Circuit

1) CPU Function

CPU circuit comprises Z-80 (A8-U12 later called MAIN CPU) to control real time section and other Z-80 (A14-U4D later called SUB CPU) to control STORAGE and GP-IB.

The MAIN CPU detects SWITCH or KNOB operation via KEYBOARD circuit, and controls internal circuit. Simultaneously displays internal status on the PANEL or on the CRT. When cursors are used, the DATA across the CURSORS are displayed on the CRT. Also controls automatic self-diagnosis, key operation, and automatic self-calibration.

The SUB CPU circuit controls STORAGE and GP-IB circuit, etc., on basis of instructions from the MAIN CPU, and handles self-diagnosis and self-calibration of STORAGE circuit.

2) Address MAP

Figure 3-4 shows the MAIN CPU ADDRESS MAP. Table 3-3 shows ROM/RAM REFERENCE DESIGNATOR and parts name .

| ROM and RAM   | REF. DESIGNATOR<br>and PARTS NAME |
|---------------|-----------------------------------|
| ROM           | A8-U13 27256                      |
| RAM           | A8-U15 6116-3                     |
| COMMON RAM    | A8-U33 6117-3                     |
| CHARACTER RAM | A8-U85 6116-3                     |
| SEQUENCER RAM | A4-U59 H41                        |

Note) The SEQUENCER RAM employs 4416 (1 k Byte) in H41.

Table 3-3 ROM/RAM circuit figure number.

The COMMON RAM works as buffer memory for the MAIN and SUB C.P.U. The DATA are switched in 1 ms interval.

The CHARACTER RAM displays PANEL DATA and CURSOR DATA on the CRT.

The SEQUENCE CONTROLLER (A4-U59 H41) controls vertical and horizontal mode on basis of PANEL setting.

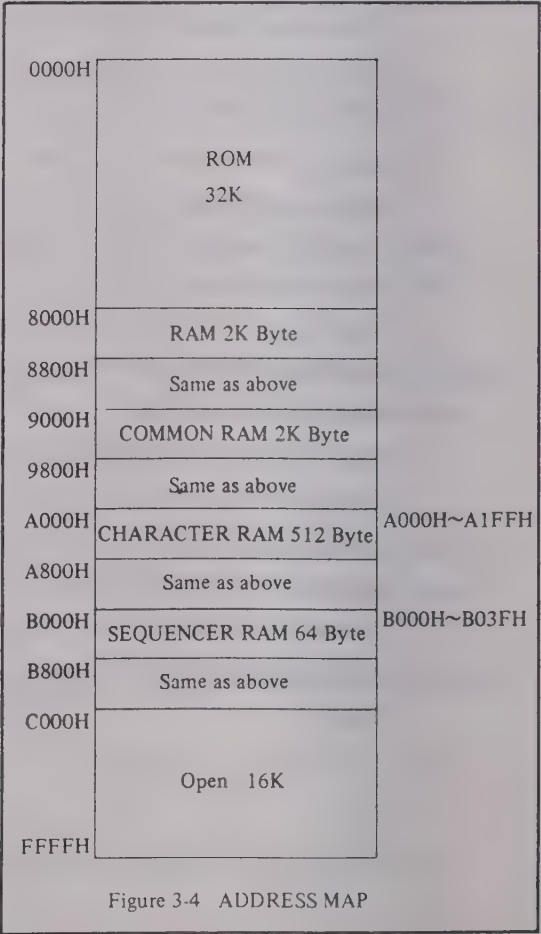


Figure 3-4 ADDRESS MAP



### 3) I/O Map

Table 3-4 shows MAIN CPU I/O MAP

| PORT No. | IN/OUT | DEVICE  |         | DESCRIPTION                                                                          |
|----------|--------|---------|---------|--------------------------------------------------------------------------------------|
| 00H(E0)  | IN/OUT | A10-U17 | 8279    | INPUT DATA from KEY SW MATRIX CKT and OUTPUT DATA to LED DRIVE CKT.                  |
| 01H      | IN/OUT | A10-U17 | 8279    | READ STATUS of 8279 & WRITE COMMAND of 8279.                                         |
| 10H(E1)  | INPUT  | A10-U7  | HC541   | PULSE COUNT DATA of CH1/CH2 VOLTS/DIV.                                               |
| 11H      | INPUT  | A10-U8  | HC541   | FLAG of CH1/CH2 UNCAL/CAL, TIME/DIV A/B and UNCAL/CAL, PULSE COUNT DATA of TIME/DIV. |
| 12H      | OUTPUT | A10-U11 | HC574   | PANEL SETTING DATA, D/A CONVERT DATA (4 Bit).                                        |
| 13H      | OUTPUT | A10-U13 | HC193   | Clear signal for PULSE COUNT DATA. (CH1 VOLTS/DIV)                                   |
|          |        | A10-U14 | HC193   | Clear signal for PULSE COUNT DATA. (CH2 VOLTS/DIV)                                   |
|          |        | A10-U15 | HC193   | Clear signal for PULSE COUNT DATA. (TIME/DIV)                                        |
|          |        | A10-U6  | MC14538 | Clear signal for IRQ OUTPUT.                                                         |
| 14H      | OUTPUT | A10-U12 | HC574   | Data for D/A CONVERT DATA (8 Bit).                                                   |
| 15H      | INPUT  | A10-U16 | HC365   | Buffer for output data of comparator.                                                |
| 20H(E2)  | IN/OUT | A8-U01  | HC74    | Clear signal for 2 ms INT.                                                           |
| 30H(E3)  | IN/OUT | A4-U10  | HC74    | Clear signal for OVER LOAD PROTECTOR INT.                                            |
| 40H(E4)  | IN/OUT | A8-U63  | HC107   | Clear signal for COUNTER INT.                                                        |
| 50H(E5)  | IN/OUT | A8-U51  | HC107   | Clear signal for COUNTER DATA.                                                       |
|          |        | A8-U55  | HC390   | Clear signal for COUNTER DATA.                                                       |
|          |        | A8-U65  | HC74    | Clear signal for COUNTER DATA.                                                       |
| 60H(E6)  | OUTPUT | A8-U107 | HC4094  | LATCH PULSE for SERIAL DATA of U107.                                                 |
| 70H(R0)  | INPUT  | A8-U36  | HC541   | INT (Interrupt) REQ FLAG.                                                            |
| 70H(W0)  | OUTPUT | A8-U37  | HC174   | Select function mode of U38.                                                         |
| 74H(R1)  | INPUT  | A8-U38  | HC299   | Data for serial output.                                                              |
| 74H(W1)  | OUTPUT | A8-U38  | HC299   | CLOCK for SERIAL DATA.                                                               |
| 78H(R2)  | INPUT  | A8-U    | HC257   | COUNTER DATA & STATUS.                                                               |
|          |        | A8-U56  | HC257   | COUNTER DATA.                                                                        |
| 78H(W2)  | OUTPUT | A8-U102 | HC4049  | LATCH PULSE for SERIAL DATA of U102.                                                 |
| 7CH(R3)  | INPUT  | A8-U113 | HC74    | FRAME REQUEST CLOCK.                                                                 |
| 7CH(W3)  | OUTPUT | A8-U62  | HC4049  | LATCH PULSE for SERIAL DATA of U62.                                                  |

Table 3-4 MAIN CPU I/O MAP



#### 4) Keyboard Circuit

Keyboard circuit is entirely similar to personal computer keyboard. All panel switches are located above key-matrix. The circuit comprises PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17 8279), 3-8 LINE DECODER (A11-U8 HC138) and KEY MATRIX circuit.

Fig. 3-5 Shows Keyboard Circuit.

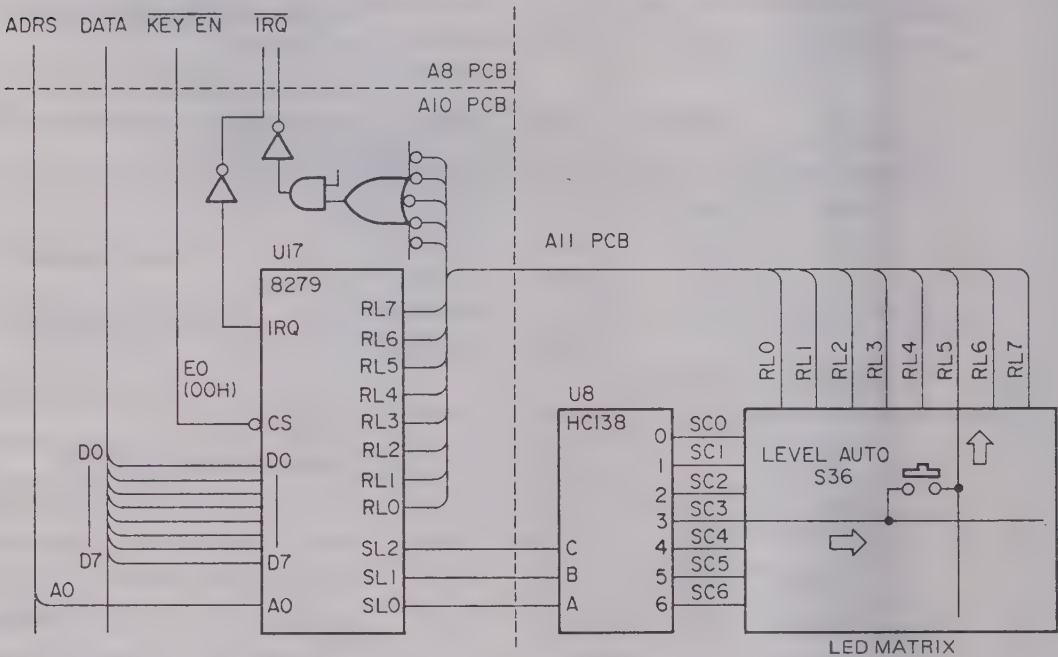


Fig. 3-5 Keyboard Circuit

The PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17) continuously scans the matrix keys. SL0 ~ SL2 continuously feed BINARY CORD for the scanning. 3-8 LINE DECODER (A11-U8) decodes the BINARY CODE and continuously scans all key matrix keys.

When if "LEVEL AUTO" key (A11-S36) is pressed, each SC0 ~ SC6 LINE consecutively turn to "H", and when SC3 turns to "H", the signal is sent to RL5. Thus determine which matrix key has been pressed. U17 feed preset CODE to DATA BUS.

When "H" is sent to RL5, CPU is ready to accept the data from DATA BUS. The CPU accepts the DATA and detects "LEVEL AUTO" key has been pressed.

KEY EN signal is a chip select signal from I/O ADDRESS DECODER (A8-U45 HC138), which delivered to 00H ~ 0FH.

However U17 functions only when 00H ~ 01H I/O address is selected since A0 is fed from the ADDRESS BUS.

Table 3-5 Shows Panel Format above the Key matrix

|     |              |          |             |              |                |               |                       |                  |
|-----|--------------|----------|-------------|--------------|----------------|---------------|-----------------------|------------------|
|     | RL0          | RL1      | RL2         | RL3          | RL4            | RL5           | RL6                   | RL7              |
| SC0 | S01          | S02      | S03         | S04          | S05            | S06           | BINT/SCAL<br>/READOUT | BEAM<br>FIND     |
|     | CH1 COUPLING |          |             | CH2 COUPLING |                |               |                       |                  |
|     | AC/DC        | GND      | 50Ω         | AC/DC        | GND            | 50Ω           |                       |                  |
| SC1 | S11          | S12      | S13         | S14          | S15            | S16           |                       |                  |
|     | CH3 COUPLING |          |             | CH4 COUPLING |                |               |                       |                  |
|     | AC/DC        | GND      | ÷5          | AC/DC        | GND            | ÷5            |                       |                  |
| SC2 | S21          | S22      | S23         | S24          | S25            | S26           | S27                   | S28              |
|     | VERT MODE    |          |             |              |                |               | BW<br>20MHz           | X-Y<br>(PEN OUT) |
|     | CH1          | ADD      | CH2         | CH3          | CH4            | ALT/CHOP      |                       |                  |
| SC3 | S31          | S32      | S33         | S34          | S35            | S36           | S37                   | S38              |
|     | HORIZ. MODE  |          |             |              | A/B<br>TRIGGER | LEVEL<br>AUTO | SLOPE<br>+/-          | X 10 MAG         |
|     | A            | ALT      | B           | B TRIG       |                |               |                       |                  |
| SC4 | S41          | S42(S49) | S43         | S44          | S45            | S46           |                       |                  |
|     | RESET        | (READY)  | SOURCE<br>B | SOURCE<br>A  | COUPLING<br>B  | COUPLING<br>A |                       |                  |
| SC5 | S51          | S52      |             | S54          | S55            |               |                       |                  |
|     | ΔT/ΔV        | DLY      |             | Ho           | AC/DC/PP       |               |                       |                  |
| SC6 | S61          | S62      | S63         | S64          | S65            | S66           | S67                   | S68              |
|     | PAUSE        | SAVE     | REF<br>MEMO | VIEW<br>TIME | TRIG<br>POINT  | ENV           | SIN/<br>PULSE         | STRG/<br>REAL    |

NOTE: BIND/SCAL/READ OUT & BEAM FIND SWITCH are located on the CRT CONTROL board (A7 PCB).

Table 3-5 Panel Switch Format

### 5) LED Display Circuit

LED display circuit employs display function of PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17 8279).

PANEL LEDs are located above matrix as same as keyboard switches.

LED display circuit comprises the PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17 8279), 3-8 LINE DECODER (A11-U2, U4 HC138), DISPLAY DRIVER (A11-U1, U3, U5), and LED matrix.

Figure 3-6 shows LED Display Circuit.

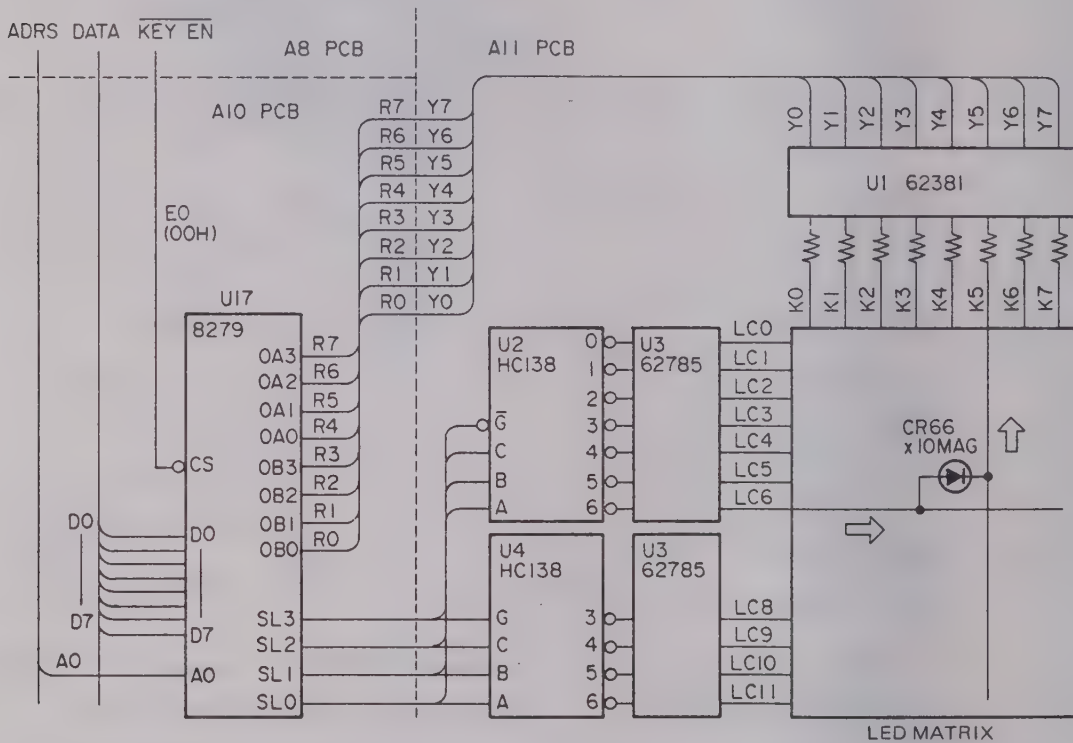


Figure 3-6 LED Display Circuit

The PROGRAMMABLE KEYBOARD/DISPLAY CONTROLLER (A10-U17) scans keys on the keyboard, and displays LED.

SL0 ~ SL3 continuously feed BINARY CODE. 3-8 LINE DECODER (A11-U2, U4 HC138) decodes the BINARY CODE, and continuously scans LED MATRIX LEDs. U3 (TD62785) located next to 3-8 LINE DECODER is INVERTED BUFFER, and each LC0 ~ LC11 LINE consecutively turns to "H".

When if "x 10 MAG" LED (A11-CR66) is in "ON", output of U17 OA1 is "H", and LC6 is also "H" at the same time.

Table 3-6 Shows Panel LED Format above the LED Matrix.

|      |                    |                  |                 |                |                       |                  |                |           |
|------|--------------------|------------------|-----------------|----------------|-----------------------|------------------|----------------|-----------|
|      | K0                 | K1               | K2              | K3             | K4                    | K5               | K6             | K7        |
| LC0  | CR01               | CR02             | CR03            | CR04           | CR05                  | CR06             | CR07           | CR08      |
|      | CH1 COUPLING       |                  |                 |                | CH2 COUPLING          |                  |                |           |
|      | AC                 | DC               | GND             | 50Ω            | AC                    | DC               | GND            | 50Ω       |
| LC1  | CR11               | CR12             | CR13            | CR14           | CR15                  | CR16             | CR17           | CR18      |
|      | CH3 COUPLING       |                  |                 |                | CH4 COUPLING          |                  |                |           |
|      | AC                 | DC               | GND             | +5             | AC                    | DC               | GND            | +5        |
| LC2  | CR21               | CR22             | CR23            | CR24           | CR25                  | CR26             | CR27           | CR28      |
|      | VERT MODE          |                  |                 |                |                       |                  |                |           |
|      | CH1                | ADD              | CH2             | CH3            | CH4                   | ALT              | CHOP           | 20 MHzz   |
| LC3  | CR31               | CR32             | CR33            | CR34           | CR35                  | CR36             | CR37           | CR38      |
|      | TRIGGER            |                  | A TRIGGER LEVEL |                |                       | B TRIGGER LEVEL  |                |           |
|      | A                  | B                | AUTO            | +              | -                     | AUTO             | +              | -         |
| LC4  | CR41               | CR42             | CR43            | CR44           | CR45                  | CR46             | CR47           | CR48      |
|      | A TRIGGER SOURCE   |                  |                 |                | B TRIGGER SOURCE      |                  |                |           |
|      | CH1                | CH2              | CH3             | CH4            | CH1                   | CH2              | CH3            | CH4       |
| LC5  | CR51               | CR52             | CR53            | CR54           | CR55                  | CR56             | CR57           | CR58      |
|      | MODE               |                  |                 | SOURCE<br>LINE | A TRIGGER<br>COUPLING |                  | TRIGGER SOURCE |           |
|      | AUTO               | NORM             | SINGLE          |                | TV-H                  | TV-V             | V-M (A)        | V-M (B)   |
| LC6  | CR61               | CR62             | CR63            | CR64           | CR65                  | CR66             | CR67           |           |
|      | HORIZONTAL MODE    |                  |                 |                |                       | HORIZ.<br>X10MAG | CH2 INV        |           |
|      | A                  | ALT              | B               | B TRIG         | X-Y                   |                  |                |           |
| LC8  | CR81               | CR82             | CR83            | CR84           | CR85                  | CR86             | CR87           | CR88      |
|      | A TRIGGER COUPLING |                  |                 |                | B TRIGGER COUPLING    |                  |                |           |
|      | AC                 | LF REJ           | HF REJ          | DC             | AC                    | LF REJ           | HF REJ         | DC        |
| LC9  |                    |                  | CR93            | CR94           | CR95                  |                  |                |           |
|      |                    |                  | READOUT         |                |                       |                  |                |           |
|      |                    |                  | Ho              | A ≠ B          | DLY                   |                  |                |           |
| LC10 | CR101              | CR102            | CR103           | CR104          | CR105                 | CR106            |                |           |
|      | DVM                |                  |                 | CURSOR         |                       |                  |                |           |
|      | AC                 | DC               | P-P             | Δt             | 1/ΔV                  | ΔV               |                |           |
| LC11 | CR111              | CR112            | CR113           | CR114          | CR115                 | CR116            | CR117          | CR118     |
|      | GP-IB<br>RMT       | REFERENCE MEMORY |                 |                |                       | STORAGE          |                |           |
|      |                    | 4                | 3               | 2              | 1                     | ENV              | SIN/PULSE      | STRG/REAL |

Table 3-6 Panel LED Format



3.2.7 Power Supply Circuit

Power Supply Circuit comprises two pairs of multi output switching circuit and series regulator to stabilize the output.

The switching circuit is called ON/OFF convertor.

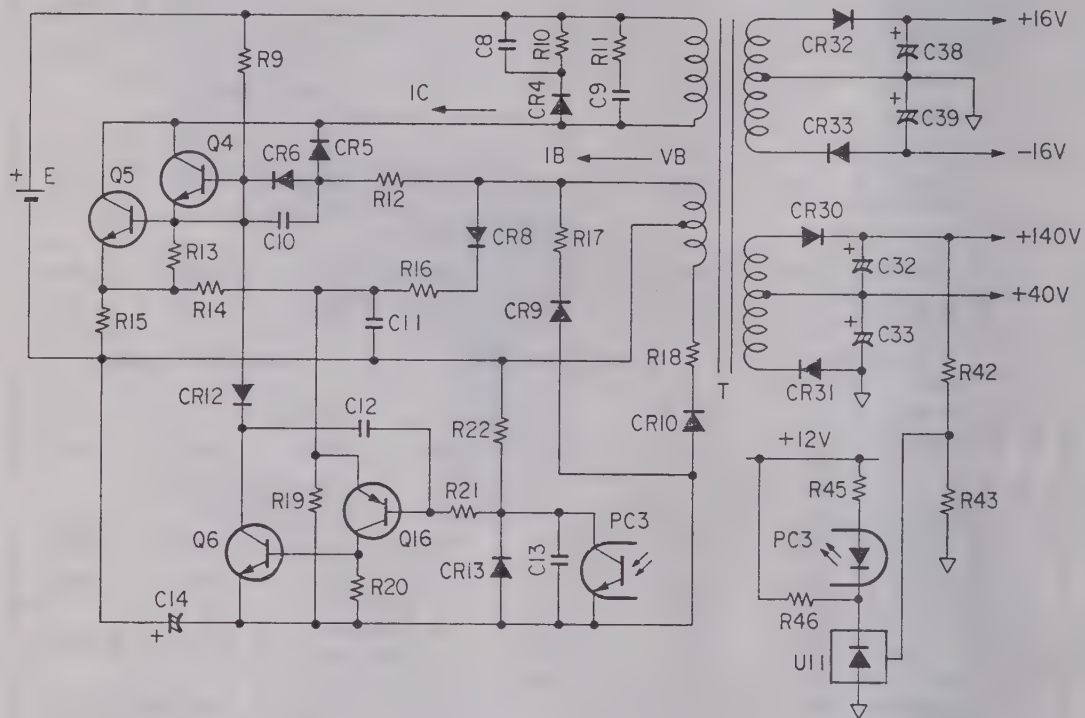


Figure 3-7 Switching Circuit

When the power is turned ON, unregulated voltage ( $E$ ) is applied to the convertor circuit.

The base current of  $Q4$  via starting resistor ( $R9$ ), turns switching transistor ( $Q5$ ) ON which induce the base winding voltage ( $VB$ ) that turns the switching transistor ( $Q5$ ) ON till saturate.

When the base winding voltage ( $VB$ ) comes high before the transformer magnetic flux saturates, transistors ( $Q16$ ,  $Q6$ ) of the voltage regulator circuit turn diode ( $CR8$ ) ON, which pull the base potential of  $Q4$  to negative potential, and turn transistor ( $Q5$ ) OFF. Then the energy stored in transformer is sent to the secondary rectifier circuit. And when the energy is fully transferred, the switching transistor ( $Q5$ ) turn ON.

Output voltage from the secondary rectifier is detected by shunt regulator ( $U1$ ) in reference to  $+12$ , isolated by photo-coupler ( $PC3$ ), and stabilized by the voltage control circuits.



# **SECTION 4**

## **CALIBRATION**

First Edition First Printing March 1988



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## 4. CALIBRATION

### 4-1 General

Recommended calibration cycle for this oscilloscope is one year under normal operation. Shorter calibration cycle may be recommended when the ambient condition are not well controlled.

Calibration consists of function operation checks and adjustments. First, operation checks of the functions are performed in which the units performance and functions are checked. These checks include a check of the specifications.

If there are items in the performance, functions or standards which cannot be satisfied, they will be readjusted in the adjustment procedure. At this time you should check that the adjustment item has been independently adjusted and that the operation has been completed as well as checking if the adjustment procedure has had an effect on another item (e.g., adjustment of the supply voltage). Fig. 4-1 shows the flow chart of the calibration procedure.

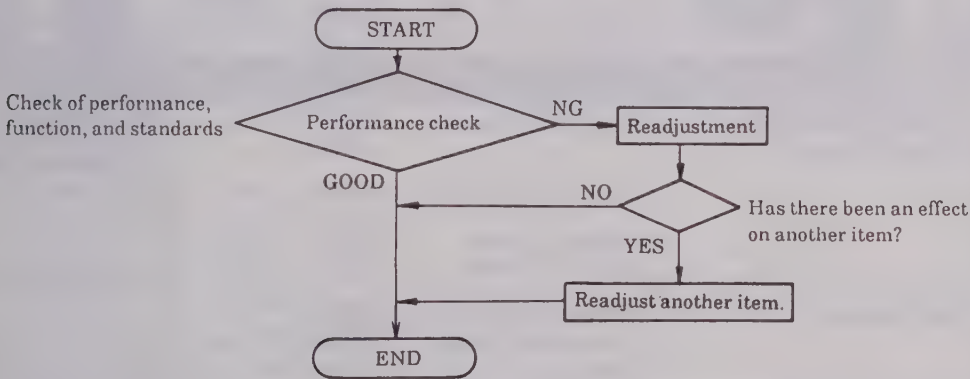


Fig. 4-1 Calibration Procedure Flow Chart

Optimum environmental conditions for the calibration of the unit are a temperature of  $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$  and humidity of  $60\% \pm 5\%$ . Care should be taken when calibration are made at a location that receives wind from , for instance, the opening and closing of doors since calibration faults may occur in unexpected places.

When making calibration use calibrator which have been correctly calibrated and be careful of the supply voltage that is applied to them.

Perform sufficient warm up time on each piece of equipment used including this unit.

## 4-2 Preparations for Calibration

### 4-2-1 Table of instruments

The measuring instruments that are necessary for calibrating this oscilloscope are shown below.

| Measuring instrument                |                                          | Performance                                                                                                                                          | Remarks                                                               |
|-------------------------------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| DC voltmeter (1)<br>(low voltage)   |                                          | Measuring range : 0 to 200V<br>accuracy : Within $\pm 0.1\%$                                                                                         | Checking internal power supply voltage                                |
| DC voltmeter (2)<br>(high voltage)  |                                          | Measuring range : 0 to 3kV<br>accuracy : Within $\pm 1\%$                                                                                            | Checking accelerator voltage                                          |
| Capacitance meter                   |                                          | Measuring range : 0 to 50pF<br>accuracy : Within $\pm 3\%$                                                                                           | Checking input capacitance                                            |
| Vertical axis calibrator            | Standard amplitude square wave generator | Output voltage : 1mV to 50Vp-p<br>accuracy : within $\pm 0.3\%$                                                                                      | Vertical axis and X-Y calibration 1kHz                                |
|                                     | Fast rise square wave generator          | Output waveform : Square wave<br>Frequency : 10Hz to 1MHz<br>Rise time : 1.0ns max<br>Flatness : Within $\pm 0.5\%$                                  | Square wave flatness adjustment                                       |
| Time mark generator                 |                                          | Mark output : 5s to 1ns<br>Output stability : Within $\pm 0.1\%$                                                                                     | Time axis calibration                                                 |
| Constant amplitude signal generator |                                          | Frequency range : 250kHz to 250MHz<br>Frequency accuracy : Within $\pm 1\%$<br>Output voltage : 5mV to 5.5Vp-p<br>Output flatness : Within $\pm 2\%$ | Vertical axis and X-Y frequency bandwidth calibration 50kHz reference |
| Oscilloscope                        |                                          | Deflection factor : 5mV to 5V/DIV<br>Frequency band : DC to 100MHz<br>Time axis : 0.5s to 20ns                                                       |                                                                       |
| Connecting cable                    |                                          | Characteristic impedance : 50ohms ;<br>Length : Approx 1m                                                                                            | At least two                                                          |
| Terminator                          |                                          | Characteristic impedance : 50ohms ;<br>Power consumption : 1/2W min                                                                                  | Two                                                                   |
| Attenuator                          |                                          | Characteristic impedance : 50ohms ;<br>Power consumption : 1/2W min                                                                                  |                                                                       |
| Screwdriver                         |                                          | 3mm screwdriver                                                                                                                                      |                                                                       |
| Adjusting screwdriver               |                                          | Low capacitance type                                                                                                                                 |                                                                       |

Table 4-1 Instruments necessary for calibration

4-2-2 Removing the case

The main unit can be pulled out from the case by first removing the four (4mm) screws of the rear panel cord winding setion as shown in Fig.4-2.

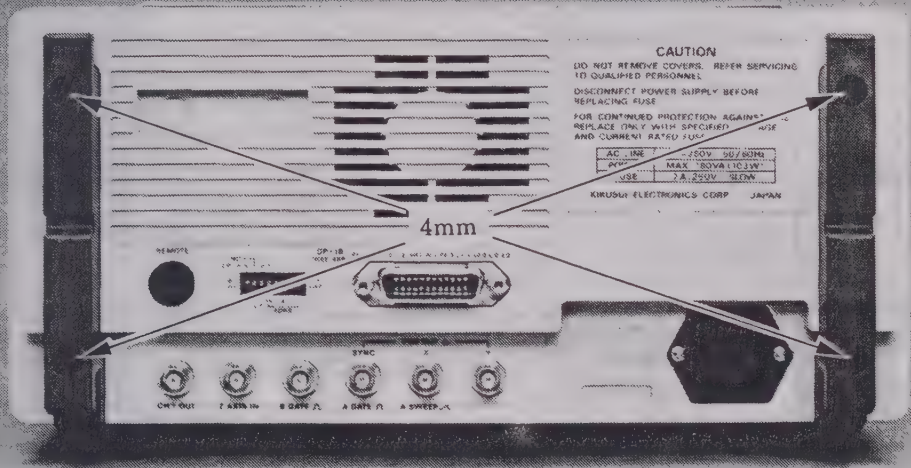


Fig 4-2 Removing the Case



### 4-2-3 Board layout

The printed circuit boards used in this oscilloscope are shown in Table 4-2, and their layout is shown in Fig. 4-2.

| Name of printed circuit board | Remarks                 |
|-------------------------------|-------------------------|
| A1 CH1, CH2 ATT               | Rear of input connector |
| A3 CH3, CH4 ATT               | Rear of input connector |
| A4 MAIN BOARD FOR STORAGE     |                         |
| A5 V&H FINAL AMP              |                         |
| A6 H-V & Z- AXIS AMP          |                         |
| A7 CRT CONTROL                | Bottom of CRT           |
| A8 MAIN CPU BOARD             |                         |
| A10 FRONT PANEL CONTROL       | Behind panel            |
| A11 FRONT PANEL SWITCH        | Behind panel            |
| A12 STORAGE POWER SUPPLY      |                         |
| A13 MOTHER BOARD STORAGE      |                         |
| A14 SUB CPU                   |                         |
| A15 ANALOG PROSESSING         | COM 7101A only          |
| A16 A/D, MEMORY               | COM 7101A only          |
| A17 AQUISITION CONTROL        | COM 7101A only          |
| A18 STORAGE DISPLAY           | COM 7101A only          |
| A19 GP-IB ADDRESS SWITCH      | COM 7101A only          |
| A20 LINE FILTER               |                         |
| A21 CRT STOCKET               |                         |
| A22 H. V UNIT                 | Inside of H. V UNIT     |
| A23 BUS BOARD                 |                         |
| A24 GP-IB DEVICE CONNECTOR    | COM 7101A only          |

Table 4-2 Printed circuit boards

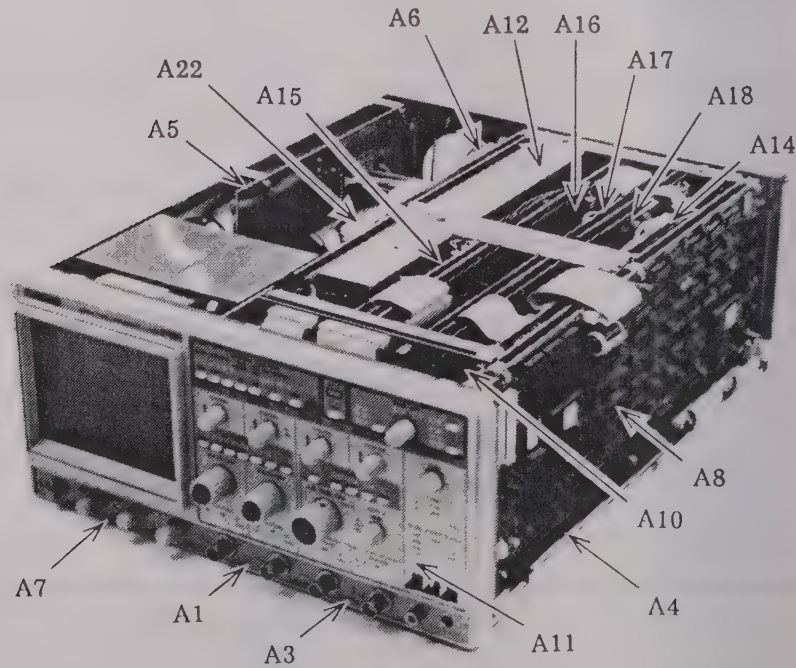


Fig. 4-3 Layout of printed circuit boards



## 4-3 Performance Checks

### 4-3-1 General

Most of the functions can be checked by performing separate checks of the unit's functions as shown below. For details on the check method see the Instruction Manual and the specification items in this Service Manual.

### 4-3-2 CRT System

#### 1) INTEN Check

- (1) No signal, or set the input coupling of the vertical axis to GND.
- (2) Rotate the INTEN knob and check that the trace is extinguished when the knob is at a position between 9 o'clock and 11 o'clock and that there is a suitable brightness at a position between 1 o'clock and 3 o'clock.
- (3) Switch the sweep time from slow speed through to high speed and check that there is no brightness irregularity of the trace on the CRT.

#### 2) FOCUS Check

- (1) Rotate the FOCUS knob and check that the focus can be properly adjusted.
- (2) Check that the best focus occurs at a position between 11 o'clock and 1 o'clock.

#### 3) Astigmatism Check

- (1) Apply an 8 DIV signal to the vertical axis so that raster appears on the CRT.
- (2) Check that there is not a barrel type or spool type of distortion on the raster.

#### 4) CRT Readout Check

- (1) Check that there are no errors in the characters of the readout.
- (2) Check that there is no dispersion of the readout or blurring of the focus.
- (3) Apply a signal to the CH1 input and check that the voltage display and the time display are within the specifications.

### 4-3-3 Vertical Axis System

#### 1) Sensitivity Check of Each Channel

- (1) Connect the output of the vertical axis calibrator to the input of CH1.
- (2) Check that the sensitivity of CH1 is within the specifications.
- (3) Perform steps (1) and (2) for each of the channels and check that the sensitivity of each of the channels is within the specifications.

#### 2) Frequency Bandwidth Check of Each Channel

- (1) Connect the output of the signal generator used for frequency bandwidth checks to the input of CH1.
- (2) Check that the frequency bandwidth of CH1 is within the specifications.
- (3) Perform steps (1) and (2) for each of the channels and check that the frequency bandwidth of each of the channels is within the specifications.

### 3) Check of the Square Wave Characteristics of Each Channel

- (1) Connect the output of the fast rise square signal generator to the input of CH1.
- (2) Check that the square wave characteristics of CH1 are within the specifications.
- (3) Perform steps (1) and (2) for each of the channel.

### 4) Input Coupling Check

- (1) Apply the AC signal accompanying the direct current to the input of CH1.
- (2) Set the input coupling of CH1 to AC.
- (3) Check that the waveform displayed on the CRT screen is only an AC signal.
- (4) Set the input coupling of CH1 to DC.
- (5) Check that the waveform displayed on the CRT screen is the AC signal accompanying the direct current.
- (6) Set the input coupling of CH1 to GND.
- (7) Check that the waveform on the CRT screen is distinguished and that only the straight line remains.
- (8) Disconnect the input signal.
- (9) Switch between AC- DC - GND position and check that there is no trace shifts.
- (10) Perform steps (1) through (8) for each channel.

### 5) DC Balance Check

- (1) Set the input coupling of CH1 to GND.
- (2) While switching the input sensitivity of CH1 from 1mV/DIV through to 5 V/DIV check that there is no movement of the bright line.
- (3) Operate the CH1 variable and check that there is no movement of the bright line.
- (4) Performs steps(1) through (3) for each channel.

### 6) Check of Vertical position range.

- (1) Set the input coupling of CH1 to GND.
- (2) Rotate the CH1 vertical axis position knob and check that the trace moves in excess of  $\pm 8\text{DIV}$ .
- (3) Perform steps (1) and (2) for each channel.

### 7) Operation Checks of Single and Double Phenomena

- (1) Set the input coupling of each channel to GND.
- (2) Press "CH1," "CH2," "CH3," and "CH4" of the "VERT MODE" in order and check for the occurrence of phenomena 1 through 4.
- (3) Switch "ALT/CHOP" of the "VERT MODE" and check that the ALT sweep and the CHOP sweep operate properly.

### 8) INV Operation Check

- (1) Apply a time mark signal to the CH2 input.
- (2) Press the CH2 knob and check that the waveform inverts.

#### 9) ADD Operation Check

- (1) Apply the same signal to CH1 and CH2.
- (2) Press the ADD key and set the unit to the ADD condition.
- (3) Check that twice the amplitude of CH1 or CH2 can be observed on the screen.

#### 10) BWL (20 MHz) Operation Check

- (1) Apply a 100MHz signal to the CH1 input.
- (2) Press the BW key and set the BANDWIDTH LIMIT condition.
- (3) Check that the amplitude of the waveform on the screen decreases.

### 4-3-4 Trigger System

#### 1) Trigger Sensitivity Check

- (1) Connect the output of the constant amplitude signal generator to the CH1 input.
- (2) Vary the frequency and output level of the signal and check that the sensitivity of the INT-A trigger is within the standard.
- (3) Perform steps (1) and (2) for each channel.
- (4) Perform the same check for the B trigger.

#### 2) Trigger Level Check

- (1) Connect the output of a low-frequency oscillator set to 50 kHz to the CH1 input.
- (2) Adjust the output of the low-frequency oscillator and set the amplitude of the CRT screen to 8 DIV.
- (3) Check that the position of the trigger can be varied from the positive peak to the negative peak of the observed waveform.
- (4) Perform the same check for the B trigger.

#### 3) Check of the Polarity (SLOPE = + / -)

- (1) Adjust the output of the low-frequency oscillator to 4 DIV.
- (2) Check that the trigger has been applied with a positive slope when the trigger slope has been set to "+" as well as with a negative slope when the trigger slope has been set to "-".
- (3) Perform the same check for the B trigger.

#### 4) Check of the Sweep Mode (AUTO, NORM, SINGLE)

- (1) Set the sweep mode to AUTO.
- (2) turn the trigger level knob to C.C.W or C.W position, observe that the trace is free running.
- (3) Set the sweep mode to NORM.
- (4) Check that the trace is not swept when in the same condition mentioned above.
- (5) Adjust the trigger level knob to have stable display.
- (6) Temporarily disconnect the output of the low-frequency oscillator connected to the CH1 input.
- (7) Set the sweep mode to SINGLE.

- (8) Press the mode select level down further and check that the unit enters the sweep standby mode and that the "READY" LED light up.
- (9) Reconnect the output of the low-frequency oscillator to the CH1 input.
- (10) Check that a single sweep is performed only once.

#### **4-3-5 Horizontal Axis System**

##### **1) Check of the Sweep Time**

- (1) Connect a time marker generator to the CH1 input.
- (2) Check that the A sweep time is within the specifications.
- (3) Check that the B sweep time is within the specifications.

##### **2) Sweep magnifier Check**

- (1) Connect a time marker generator to the CH1 input.
- (2) Turn the  $\times 10$  MAG switch on, check that the sweep accuracy is within the specifications.
- (3) Repeat the check for B-sweep too, set the  $\times 10$  MAG switch at off position after completion of the check.

##### **3) Check of the hold-off Time**

- (1) Connect a time marker generator to the CH1 input.
- (2) Rotate the hold-off knob and check that the hold-off time varies.

##### **4) Check of the Delayed Sweep Operation**

- (1) Connect a time marker generator to the CH1 input.
- (2) Select a continuous delay operation.
- (3) Vary DELAY TIME and check that there are no irregularities in the continuous delay operation.
- (4) Set the triggered after delay operation.
- (5) Vary DELAY TIME and check that there are no irregularities in the triggerable after delay operation.

##### **5) Check of the X-Y Operation**

- (1) Connect the output of the vertical axis calibrator to the X-axis (CH1) input.
- (2) Set the X-Y operation.
- (3) Check that the sensitivity of the X-axis (CH1) is within the specifications.
- (4) Connect the output of the constant amplitude signal generator to the input of the X-axis (CH1).
- (5) Check that the frequency bandwidth of the X-axis (CH1) is within the specifications.
- (6) Check the Y-axis (CH2) in the same way.



#### 4-3-6 Storage System (COM 7101A only)

##### 1) A/D Conversion Check

- (1) Apply a 50kHz, 8divisions amplitude sin wave from constant amplitude signal generator to the CH1 input.
- (2) Set the unit to storage mode.
- (3) Check that the 8 DIV waveform (storage) is on the CRT screen.

##### 2) Repeat Operation Check

- (1) Apply a 10MHz, 8divisions amplitude sin wave from constant amplitude signal generator to the CH1 input.
- (2) Set the unit to storage mode.
- (3) Set the unit's time axis to the region of repeat operation. (1  $\mu$ s/DIV to 10 ns/DIV)
- (4) Check that the unit has entered the repeat operation and that the 8 DIV waveform (storage) is observable on the CRT screen.

##### 3) Role Operation Check

- (1) Connect the output of a low frequency signal generator set to 1Hz to the CH1 input.
- (2) Adjust the output of the signal generator and set the amplitude of the CRT screen to 4 DIV.
- (3) Set the unit to storage mode.
- (4) Set the unit's time axis to the region of role operation. (5 s/DIV to 0.1 s/DIV)
- (5) Check that the unit has entered the role operation, the waveform, (storage) on the CRT screen to the left, and that a new waveform continues to be observed.

##### 4) Envelope Operation Check

- (1) Connect the output of a constant amplitude signal generator set to 50MHz to the CH1 input.
- (2) Adjust the output of the signal generator and set the amplitude of the CRT to 6 DIV.
- (3) Set the unit to storage mode.
- (4) Set the unit's time axis to 10 $\mu$ s/DIV.
- (5) Vary the frequency of the signal generator slightly and check the aliasing.
- (6) Set the unit to envelope operation.
- (7) Check that the unit has entered the envelope operation and that an envelope display waveform is observed on the CRT screen.

##### 5) Save Operation Check

- (1) Connect the output of a signal generator set to 50kHz to the CH1 input.
- (2) Adjust the output of the signal generator and set the amplitude of the CRT screen to 2 DIV.
- (3) Set the unit to storage mode.



- (4) Set the unit to the pause condition and designate REF MEMORY 1.
- (5) Press the SAVE key and store the signal that has been input to CH1 in the memory .
- (6) For REF MEMORY 2 through 4, perform steps (4) and (5) and check the operation.

#### **4-3-7 GP-IB Section (with COM 7101A and GP-IB function only)**

Prepare a personal computer with the GP-IB function (hereafter abbreviated as CPU) and connect it to the unit.

See the Operation Manual for the various commands.

##### **1) Check of Each of the Function Settings**

- (1) Send the vertical axis system command from the CPU and check that the setting is made properly.
- (2) Send the trigger system command from the CPU and check that the setting is made properly.
- (3) Send the horizontal axis system command from the CPU and check that the setting is made properly.
- (4) Send the cursor command from the CPU and check that the setting is made properly.
- (5) Send the DVM and the counter commands from the CPU and check that the settings are made properly.
- (6) Send the storage command from the CPU and check that the setting is made properly.  
(Note that the remote control (RC01-COM is used.)
- (7) Send the step control command from the CPU and check that the setting is made properly.  
(Note, that the remote control RCO1-COM is used.)

##### **2) Waveform Data Transmission Check**

Send the waveform data input/output commands from the CPU and check that the settings are made properly.

## 4-4 Calibration

### 4-4-1 Calibration procedure

This oscilloscope must be calibrated correctly using the same procedure as that used when it is initially calibrated at the factory. The calibration procedure is set out in this manual so that the oscilloscope can be calibrated accurately and in as short a period as possible. Be sure, therefore, to observe this procedure.

#### 1) Initial setting

The settings of the common items using the controls and switches on the panel of the oscilloscope are shown in Table 4-3. These are the initial settings.

| FUNCTION           |                | SETTING                        | REMARKS        |
|--------------------|----------------|--------------------------------|----------------|
| Power supply       | POWER          | ON                             |                |
| CRT Circuit        | INTEN          | Adequate brightness            |                |
|                    | FOCUS          | Set to best focus              |                |
|                    | SCALE          | Turn fully left (MIN)          |                |
|                    | VERT MODE      | CH1 only, other channels off   |                |
| Vertical circuit   | VOLT/DIV       | 10mv/DIV                       |                |
|                    | VARIABLE       | CAL'D                          |                |
|                    | COUPLING       | DC (GND is OFF)                |                |
|                    | POSITION (CH1) | Center                         |                |
|                    | BW [20MHz]     | OFF                            |                |
|                    | CH2 INV        | OFF                            |                |
|                    | MODE           | AUTO                           |                |
| Trigger circuit    | SOURCE         | V-MODE (CH1)                   |                |
|                    | COUPLING       | AC                             |                |
|                    | TRIG LEVEL     | Center                         |                |
|                    | LEVEL AUTO     | ON                             |                |
|                    | SLOPE          | +                              |                |
|                    | HORIZ MODE     | A                              |                |
| Sweep circuit      | A/B TIME/DIV   | 1ms/DIV                        |                |
|                    | VARIABLE       | CAL'D                          |                |
|                    | POSITION (H)   | Set so that trace is at center |                |
| Horizontal circuit | ×10 MAG        | OFF                            |                |
|                    | CURSORSW       | HO                             |                |
|                    | READOUT CONT   | Turn fully left                | (KNOB)         |
| Readout            | DVM SW         | OFF                            |                |
|                    | STORAGE MODE   | REAL                           | COM 7101A only |

Table 4-3 Initial setting of common items

2) Self calibration

Perform self-calibration. The method of starting self-calibration of the COM7101A is slightly different to that of the COM7100A. Table 4-4 shows the method of self-calibrating model.

| Model    | Method                                                                                                                       |
|----------|------------------------------------------------------------------------------------------------------------------------------|
| COM7101A | Press the "DVM" switch while pressing the "(2nd)" function key.                                                              |
| COM7100A | Press the "INTEN" knob, momentarily release it, then while the CRT screen is in the BEAM FIND status press the "DVM" switch. |

Table 4-4 Method of starting self-calibration

While self-calibration is taking place, "SELF CAL" and also the content of calibration will appear on the CRT screen.

The self calibration period is about 2minutes and 15seconds for the COM7101A, and about 45seconds for the COM7100A.

The contents which are calibrated by the self calibration function are shown below Table 4-5, 4-6.

| Section          | Display  |                    | Content of calibration                                        |
|------------------|----------|--------------------|---------------------------------------------------------------|
| Vertical section | VERT CH1 | STEP BAL           | CH1 STEP BALANCE                                              |
|                  |          | VAR B 5            | CH1 VARIABLE BALANCE (5mV / DIV RANGE)                        |
|                  |          | GAIN 5             | CH1 GAIN (5mV / DIV RANGE)                                    |
|                  |          | PC C 5             | CH1 POSITION CENTER (5mV / DIV RANGE)                         |
|                  |          | VAR B 10           | CH1 VARIABLE BALANCE (10mV / DIV RANGE)                       |
|                  |          | GAIN 10            | CH1 GAIN (10mV / DIV RANGE)                                   |
|                  |          | PC C 10            | CH1 POSITION CENTER (10mV / DIV RANGE)                        |
|                  | VERT CH2 | STEP BAL           | CH2 STEP BALANCE                                              |
|                  |          | VAR B 5            | CH2 VARIABLE BALANCE (5mV / DIV RANGE)                        |
|                  |          | GAIN 5             | CH2 GAIN (5mV / DIV RANGE)                                    |
|                  |          | PC C 5             | CH2 POSITION CENTER (5mV / DIV RANGE)                         |
|                  |          | VAR B 10           | CH2 VARIABLE BALANCE (10mV / DIV RANGE)                       |
|                  |          | GAIN 10            | CH2 GAIN (10mV / DIV RANGE)                                   |
|                  |          | PC C 10            | CH2 POSITION CENTER (10mV / DIV RANGE)                        |
|                  |          | PC C 5<br>CH2 INV  | CH2 POSITION CENTER (10mV / DIV RANGE)<br>and CH2 INV BALANCE |
|                  |          | PC C 10<br>CH2 INV | CH2 POSITION CENTER (10mV / DIV RANGE)<br>and CH2 INV BALANCE |
| Sweep circuit    | HORIZ    | START A            | A SWEEP POINT                                                 |
|                  |          | START B            | B SWEEP POINT                                                 |
|                  |          | START COMP         | DELAY TIME COMPARATOR                                         |
|                  |          | GAIN A 1m          | A SWEEP SPEED (1ms / DIV RANGE)                               |
|                  |          | GAIN A 2m          | A SWEEP SPEED (2ms / DIV RANGE)                               |

Table 4-5 Content of self calibration (1 / 2)

| Section       | Display       |                 | Content of calibration                                        |
|---------------|---------------|-----------------|---------------------------------------------------------------|
| Sweep circuit | HORIZ         | GAIN A 5m       | A SWEEP SPEED (5ms / DIV RANGE)                               |
|               |               | GAIN A 5m       | A SWEEP SPEED (.5ms / DIV RANGE)                              |
|               |               | GAIN A 10m      | A SWEEP SPEED (10ms / DIV RANGE)                              |
|               |               | GAIN A 50μ      | A SWEEP SPEED (50μs / DIV RANGE)                              |
|               |               | GAIN A 1mN      | A SWEEP SPEED (1ms / DIV combination)                         |
|               |               | GAIN A 1mN      | A SWEEP SPEED (.1ms / DIV combination)                        |
|               |               | GAIN B 1m       | B SWEEP SPEED (1ms / DIV RANGE)                               |
|               |               | GAIN B 2m       | B SWEEP SPEED (2ms / DIV RANGE)                               |
|               |               | GAIN B 5m       | B SWEEP SPEED (5ms / DIV RANGE)                               |
|               |               | GAIN B .5m      | B SWEEP SPEED (.5ms / DIV RANGE)                              |
|               |               | GAIN B 10m      | B SWEEP SPEED (10ms / DIV RANGE)                              |
|               |               | GAIN B 50μ      | B SWEEP SPEED (50μs / DIV RANGE)                              |
|               |               | GAIN B 1mN      | B SWEEP SPEED (1ms / DIV combination)                         |
|               |               | GAIN B .1mN     | B SWEEP SPEED (.1ms / DIV combination)                        |
| DVM section   | DVM           | DC AUTO ZERO    | OFFSET calibration for DC MODE of DIGITAL VOLTMETER function  |
|               |               | AC RMS OFFS     | OFFSET calibration for RMS MODE of DIGITAL VOLTMETER function |
|               |               | AC AUTO ZERO    | OFFSET calibration for AC MODE of DIGITAL VOLTMETER function  |
|               |               | P-P AUTO ZERO   | OFFSET calibration of P-P DETECTOR                            |
|               |               | GAIN MESUR (DC) | DC GAIN calibration of DIGITAL VOLTMETER                      |
|               |               | GAIN MESUR (DC) | DC GAIN calibration of DIGITAL VOLTMETER                      |
| Storage       | No indication |                 | Each function in the storage circuit (COM7201A) only          |

Note : The term “combination” pertaining to sweep speed means that this combination is not possible in the normal sweep mode. By performing this “combination” sweep, the sweep speed will be calibrated not only in the medium speed area but also in the low speed and high speed areas as well.

Table 4-6 Content of self calibration (2/2)

After the completion of the calibration, the pannel setting will return to the original seting.



### 3) Checking for self calibration defects

By performing the following operation, the calibration setting values will be displayed on this oscilloscope, enabling the oscilloscope to be checked for possible calibration defects.

- (1) SHORT the SELF CHECK SHORT PIN on board A8 (MAIN CPU board) shown in Fig. 4-4.

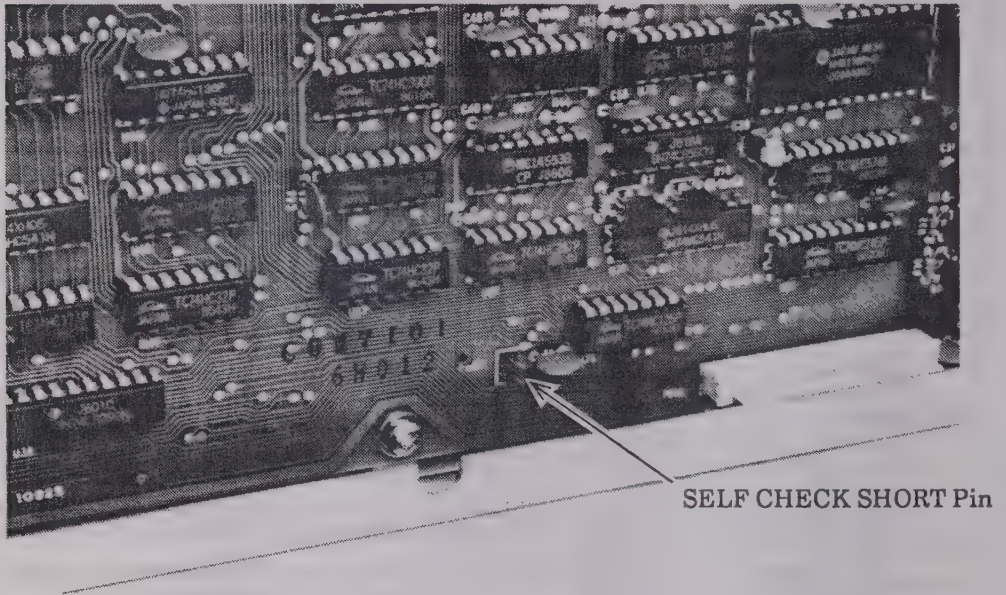


Fig. 4-4 Position of SELF CHECK SHORT PIN

- (2) Press the "INTEN" knob and momentarily release it, then press the "OUT" (SCAL) knob while the CRT screen is in the BEAM FIND status.
- (3) The HEX display (calibration setting value) will appear on the CRT screen.
- (4) Confirm that neither "FFF" nor "000" appears in the HEX display on the CRT screen. If it does, perform self calibration once again by way of precaution, and perform steps (1) to (5) once again. If "FFF" or "000" still appears in the HEX display, refer to Fig. 4-5 and Table 4-7 (table of calibration setting values), and find out at what stage of the calibration procedure the calibration defect occurred. Next, search for the function concerned and carry out repair.

#### NOTE

The HEX value is data which is sent from the CPU to the D/A converter. This value is different for each set, hence it is not possible to compare the data between sets and judge whether or not it is satisfactory.



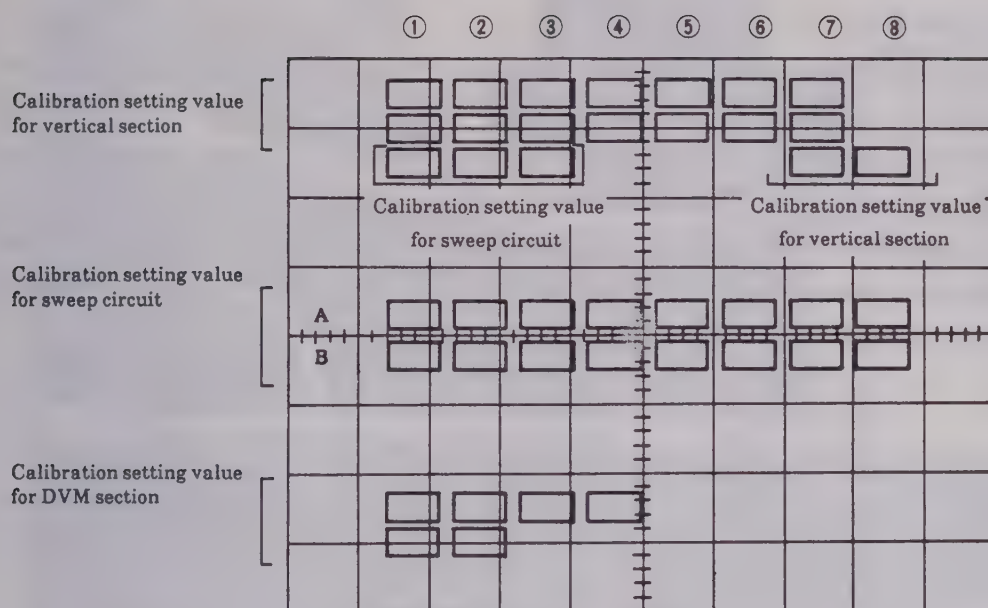


Fig. 4-5

■ Calibration setting value for vertical section

|     | ①        | ②       | ③      | ④      | ⑤        | ⑥       | ⑦                 | ⑧                  |
|-----|----------|---------|--------|--------|----------|---------|-------------------|--------------------|
| CH1 | STEP BAL | VAR B 5 | GAIN 5 | PC C 5 | VAR B 10 | GAIN 10 | PC C 10           |                    |
| CH2 | STEP BAL | VAR B 5 | GAIN 5 | PC C 5 | VAR B 10 | GAIN 10 | PC C 10           |                    |
|     |          |         |        |        |          |         | PC C 5<br>CH2 INV | PC C 10<br>CH2 INV |

■ Calibration setting value for sweep circuit

|   | START A | START B | START COMP |       |       |            |      |       |
|---|---------|---------|------------|-------|-------|------------|------|-------|
| A | 1 ms    | 2 ms    | 5 ms       | .5 ms | 10 ms | 50 $\mu$ s | 1 mN | .1 mN |
| B | 1 ms    | 2 ms    | 5 ms       | .5 ms | 10 ms | 50 $\mu$ s | 1 mN | .1 mN |

■ Calibration setting value for DVM section

|  | DC AUTO<br>ZERO  | AC RMS<br>OFFS   | AC AUTO<br>ZERO | P-P AUTO<br>ZERO |
|--|------------------|------------------|-----------------|------------------|
|  | GAIN<br>MESUR DC | GAIN<br>MESUR AC |                 |                  |

Table 4-7 Table of calibration setting values

4-4-2Checking and adjusting internal power supply voltage

1) Internal power supply voltage

The +12V power supply contained in this oscilloscope constitutes the reference for all other power supply voltages. For this reason, be sure to check the +12V power supply first and foremost. If the +12V power supply voltage is outside the range indicated in Table 4-8, adjust +12V ADJ (RV1) on board A12. After this, simply check the other power supply voltages Do not adjust them. Table 4-8 shows the value of each power supply voltage. The point for checking each voltage and also the adjustment position of +12V ADJ (RV1) are shown in Fig. 4-7 and 4-8

| Power supply voltage | Voltage range   | Remarks                  |
|----------------------|-----------------|--------------------------|
| +12V                 | +11.94V~+12.06V | +12V ADJ (RV1 – A12 PCB) |
| –12V                 | –11.94V~–12.06V |                          |
| +5Va                 | +4.75V~+5.25V   | For analog circuit       |
| +5Vd                 | +4.75V~+5.25V   | For digital circuit      |
| –5Vd                 | –4.75V~–5.25V   | For digital circuit      |
| +70V                 | +69V~+72V       |                          |
| +140V                | +133V~+147V     |                          |
| –2100V               | –2050V~2150V    |                          |

Table 4-8 Range of each internal power supply voltage

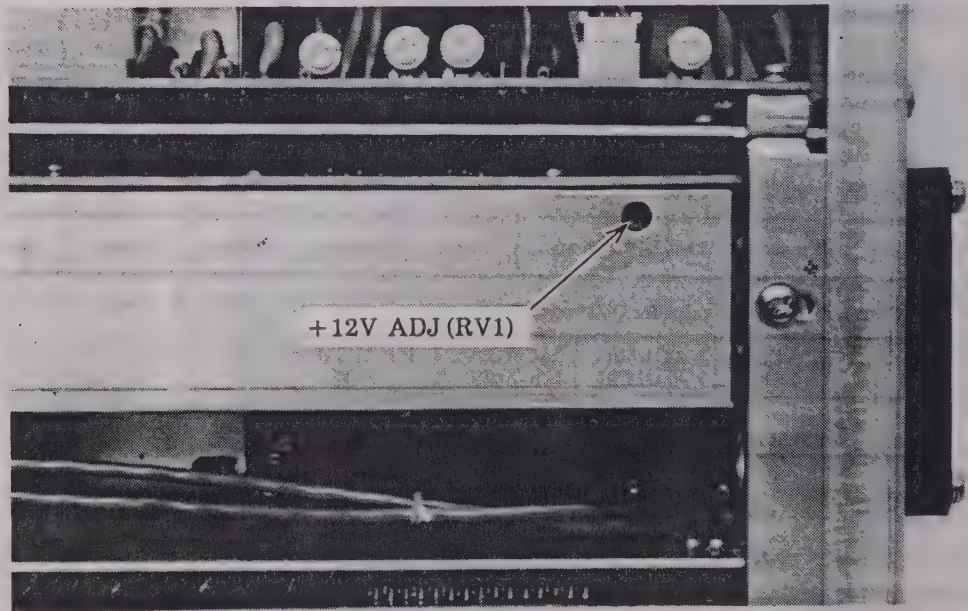


Fig. 4-6 Adjustment position of +12V ADJ (RV1)



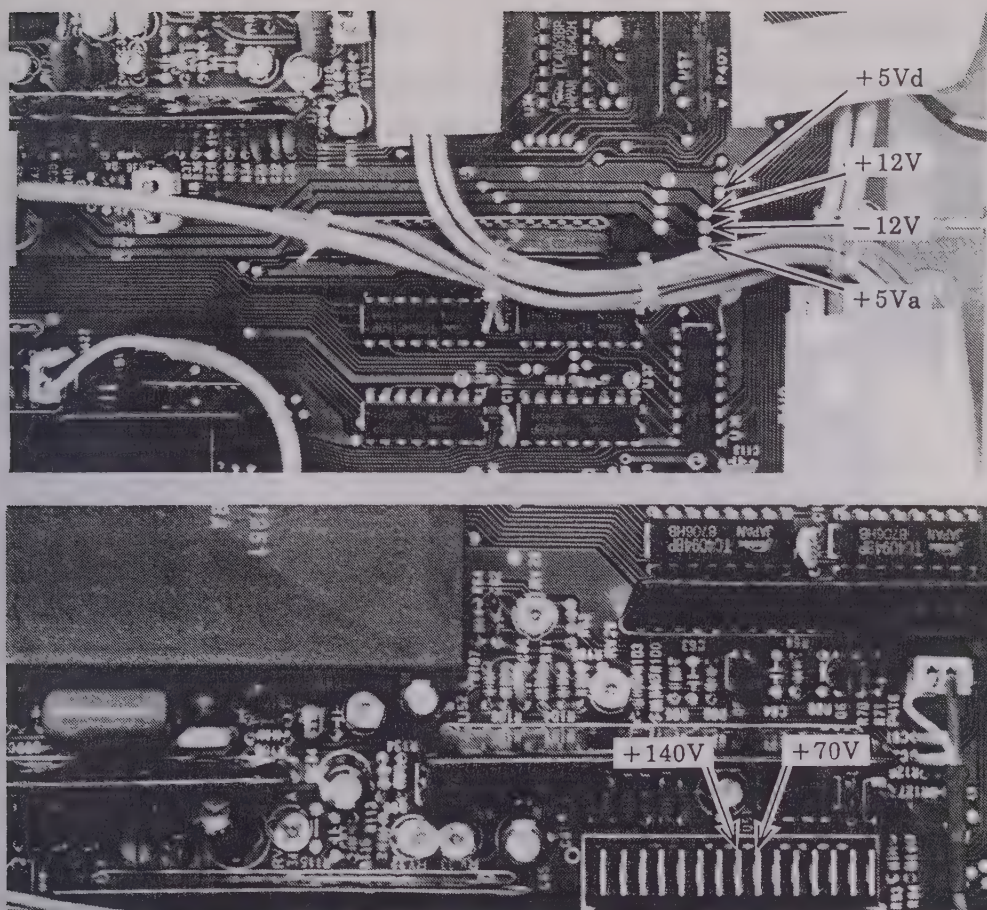


Fig. 4-7 Power supply voltage checking position

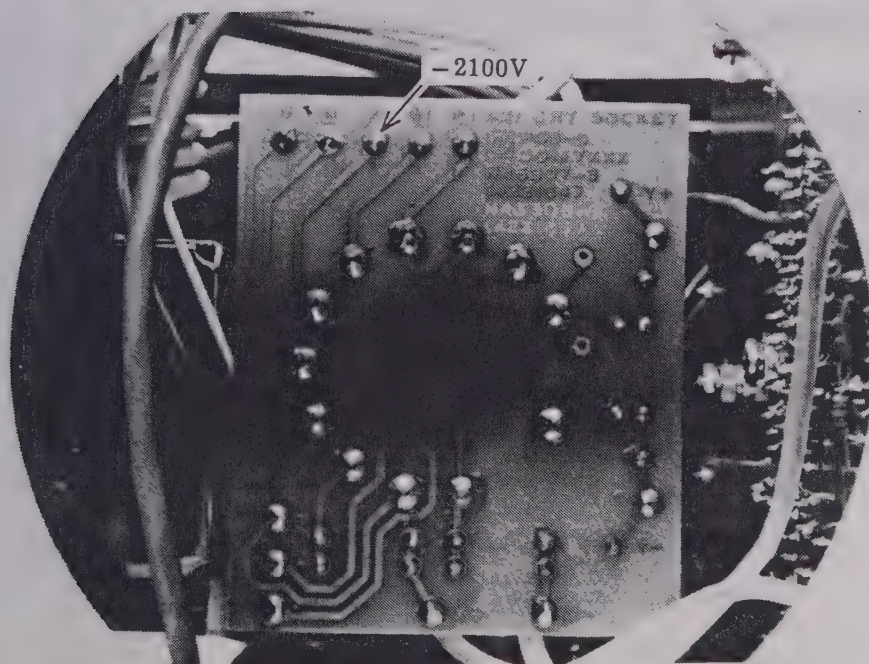


Fig. 4-8 Checking position of -2100V



2) V.REF 30 mV

Using a DC digital voltmeter, check the voltage at the R4 on board A4. It is satisfactory, if the potential is between 30.01 mV and 30.09 mV. If it is outside this range, adjust V REF (RV1) on board A4 shown in Fig. 4-9.

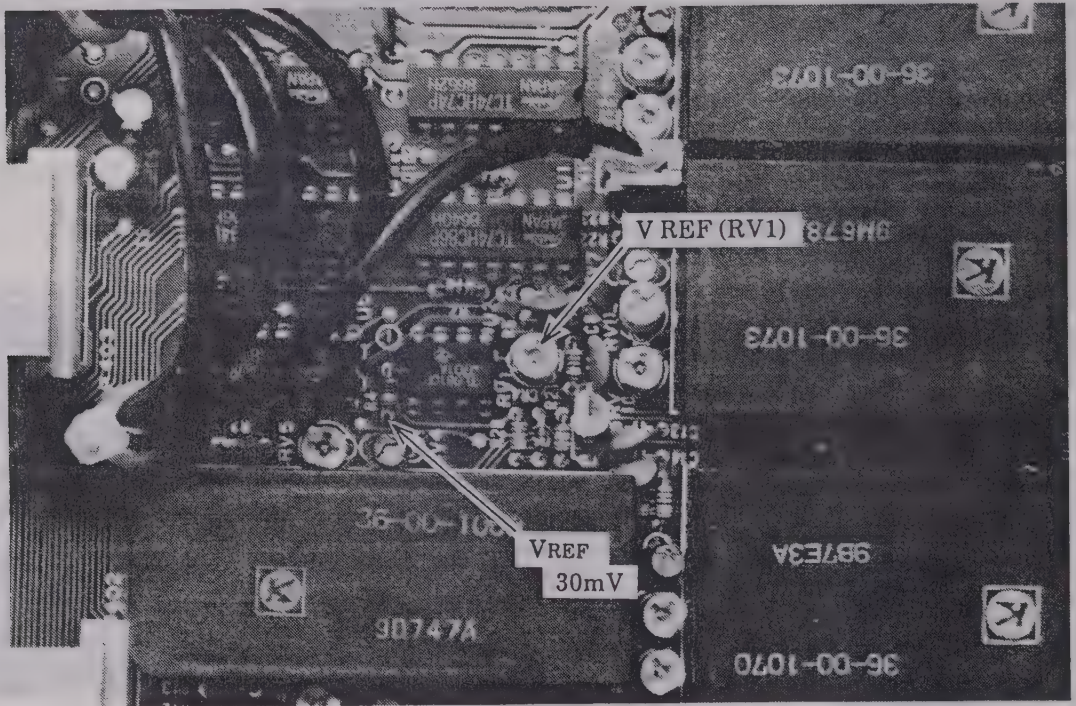


**Fig. 4-9** Adjustment position of  $V_{REF}$  (RV1)

#### 4-4-3 Checking and adjusting CRT circuit

##### NOTE

*If the voltage in the CRT circuit are adjusted in the same way as described in the previous sub-section "Checking and adjusting internal power supply voltages", the deflection factor will be affected. After adjusting these voltages, therefore, be sure to check the vertical and horizontal deflection factor and the sweep speed.*

#### 1) GEOMETRY

Check the distortion of the CRT.

- (1) Apply a 50kHz, 8DIV amplitude signal to CH1 input from signal generator.
- (2) Confirm that the waveform on the CRT is not distorted. If it is distorted, adjust GEOMETRY (RV4) on board A6 indicated in Fig. 4-10.

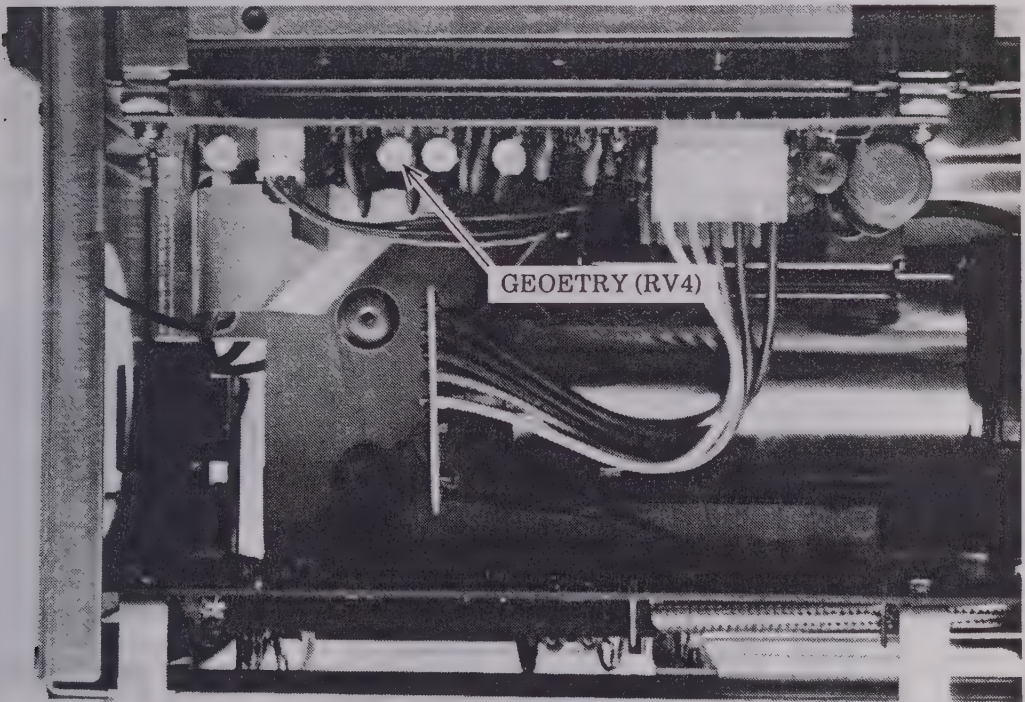


Fig. 4-10 Adjustment position of GEOMETARY (RV4)



## 2) ASTIG

- (1) Set the input coupling of CH1 and CH2 to "GND".
- (2) Set "HORIZ MODE" to "X-Y", and using each of the horizontal and vertical "POSITION" controls, output a bright spot at the center of the CRT screen.
- (3) Rotate "FOCUS" knob to a suitable position, and confirm whether or not the bright spot can be made to approach a circle without limit. If the bright spot does not approach a circle, adjust ASTIG (RV5) on board A6 shown in Fig. 4-11.

## 3) SUB FOCUS

Set the white dot on "FOCUS" knob to the 12 O'clock position, and confirm whether or not the electron beam is correctly focused. If the electron beam cannot be correctly focused when "FOCUS" knob is set to the 12 O'clock position, adjust SUB FOCUS (RV3) on board A6 shown in Fig. 4-11.

## 4) HALATION

Confirm that the characters near the periphery of the CRT are not blurred. If they are blurred, adjust HALATION (RV6) on board A6 shown in Fig. 4-11.

## 5) SUB INTEN

- (1) Set "TIME/DIV" to 1ms/DIV, and draw a single horizontal line trace across the CRT screen.
- (2) Set the white dot on "INTEN" knob to the 10 O'clock position, and confirm that the trace is faintly visible. If the trace is either too bright or cannot be seen at all, adjust CRT BIAS (RV2) on board A6 shown in Fig. 4-11.

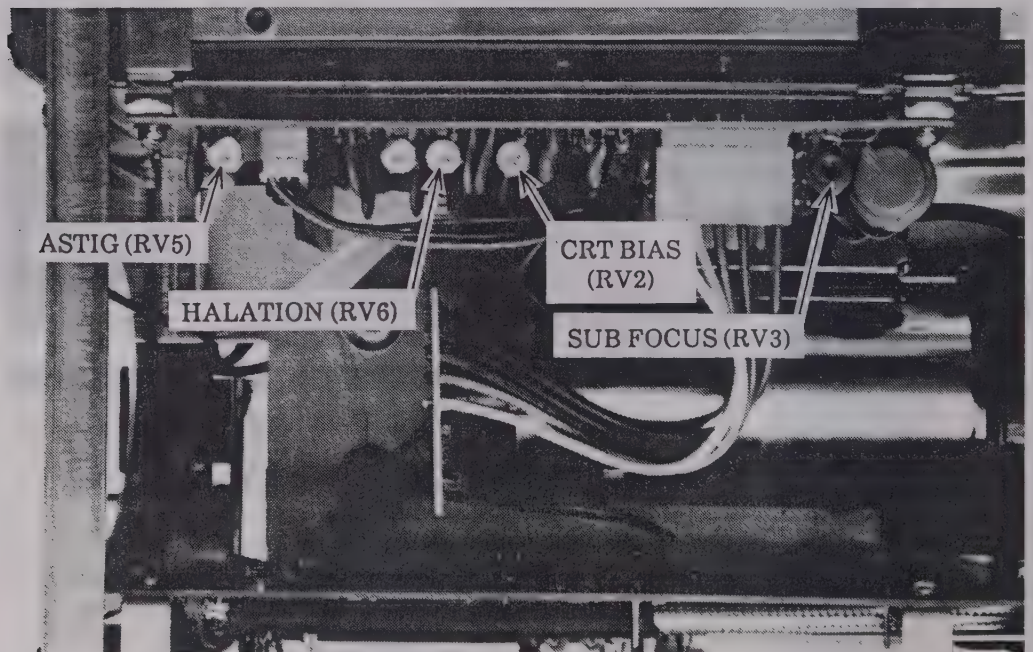


Fig. 4-11 Adjustment position of CRT circuit [ASTIG (RV5), SUB FOCUS (RV3) HALATION (RV6), CRT BIAS (RV2)]

## 6) X DEFLECTION FACTOR

- (1) Perform initial setting of the oscilloscope in accordance with Table 4-3.
- (2) Apply a 1ms time mark signal to CH1 input (terminated in 50ohms), then adjust the VOLT / DIV to get approx. 2DIV amplitude on the screen.
- (3) Confirm that the displayed period of the waveform on the CRT screen is within  $\pm 2\%$ . If it is not, adjust HORIZ GAIN ADJ (RV7) on board A5 shown in Fig. 4-12.

### NOTE

Sweep accuracy for all TIME/DIV setting. It should be within  $\pm 2\%$  for all ranges between 0.5s and 10ns.

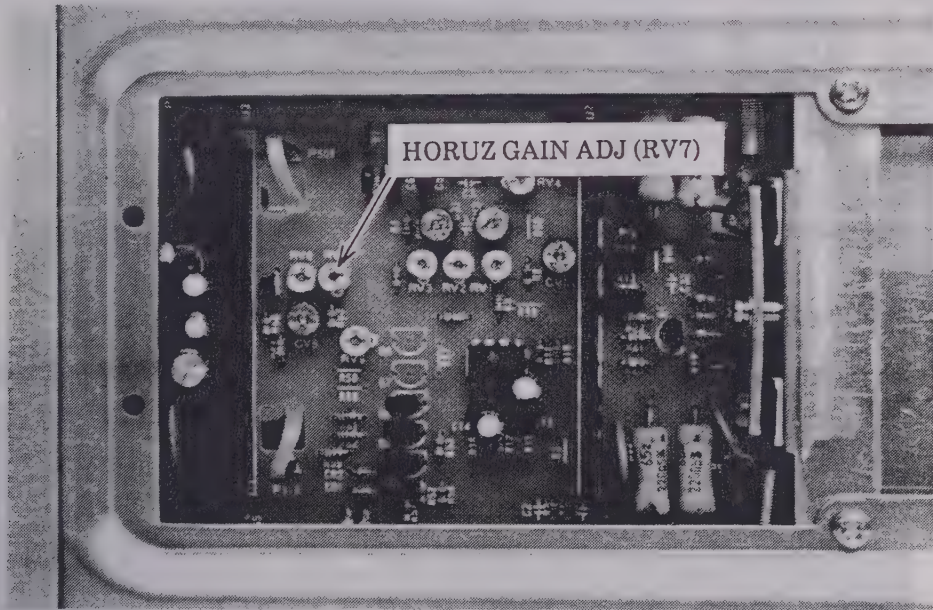


Fig. 4-12 Adjustment position of HORIZ GAIN ADJ (RV7)



## 7) X-axis position of characters and gain

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Turn "ΔT" on and display two vertical cursors on the CRT screen.
- (3) Turn the read-out control knob until the distance between the two cursors is maximum.  
(See Fig.4-13.) (For details of the method of moving the cursors, read the instruction manual.)

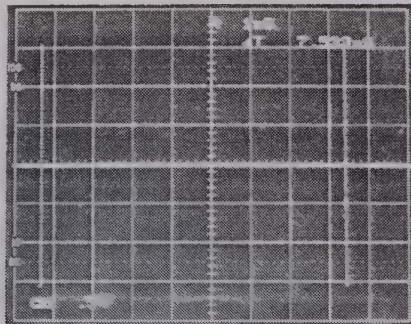


Fig. 4-13 Two vertical cursors

- (4) Confirm that the distance between the two cursors is  $10 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust CHR X GAIN (RV33) on board A4 shown in Fig.4-14.
- (5) Confirm that the positions of the two cursors are within  $\pm 0.1 \text{ DIV}$  of the 10 DIV point on the horizontal axis of the CRT screen. If they are not, adjust CHR X POSI (RV32) on board A4 shown in Fig.4-14.

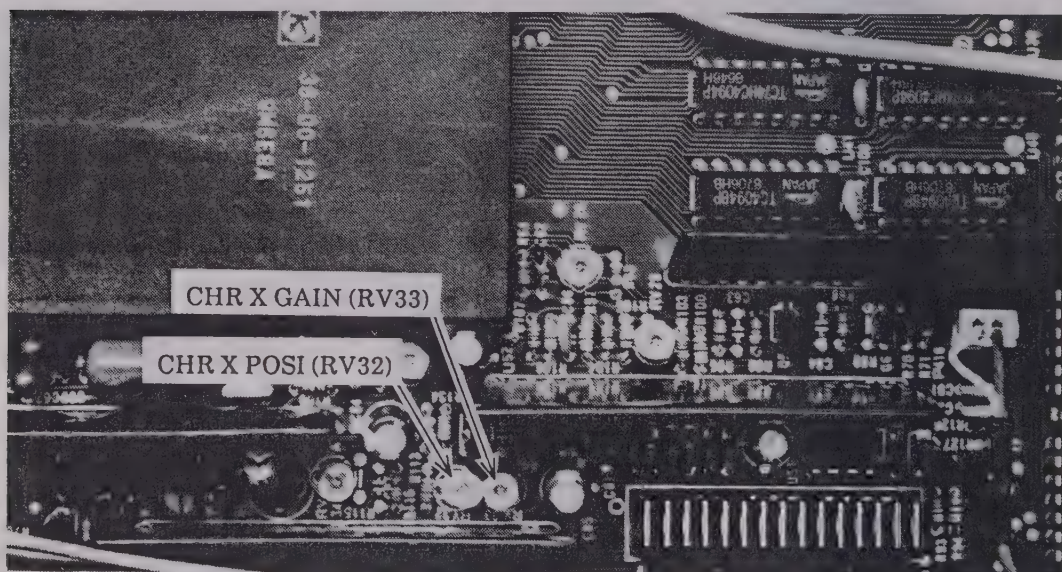


Fig. 4-14 Adjustment positions of CHR X GAIN (RV33) and CHR X POSI (RV32)

## 8) Y DEFLECTION FACTOR

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Set "TIME / DIV" to 1ms / DIV.
- (3) Connect the amplitude calibration signal output of the vertical axis calibrator which has been set to 50mVp-p, to the input of CH1 (unterminated), and confirm that the amplitude in the vertical direction is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust VERT GAIN (RV3) on board A5 shown in Fig. 4-15.

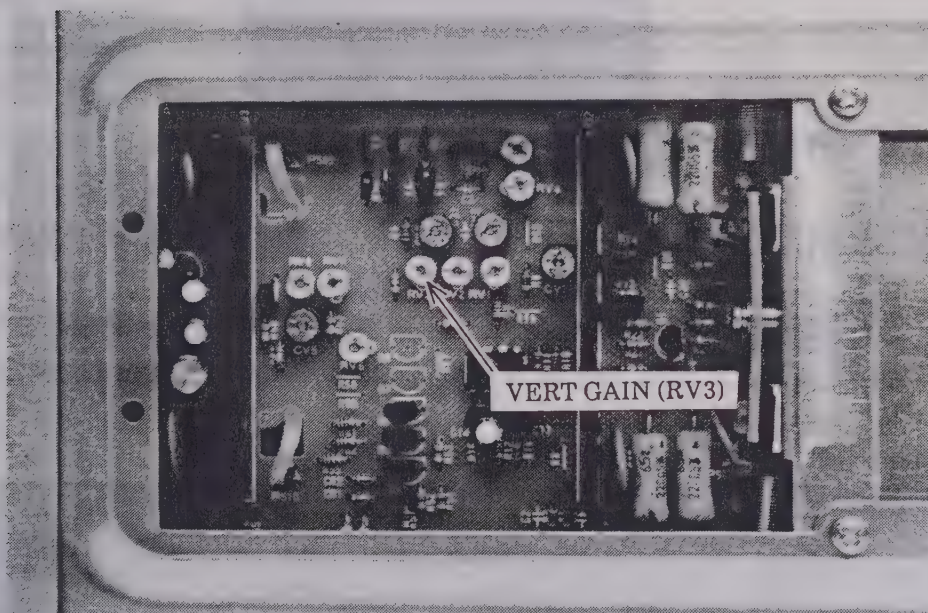


Fig. 4-15 Adjustment position of VERT GAIN (RV3)



## 9) Y-axis position of characters and gain

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Turn "ΔV" on and display two horizontal cursors on the CRT screen.
- (3) Turn the read-out control knob until the distance between the two cursors is maximum.  
(See Fig.4-16.) (For details of the method of moving the cursor, read the instruction manual.)

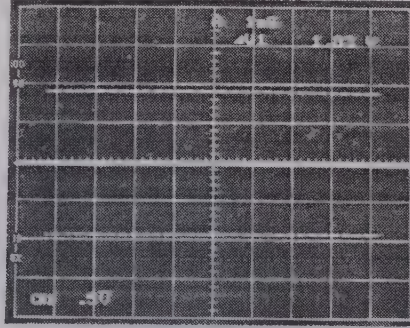


Fig.4-16 Two horizontal cursors

- (4) Confirm that the distance between the two cursors is  $8 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust CHR Y GAIN (RV21) on board A4 shown in Fig. 4-17.
- (5) Confirm that the positions of the two cursors are within  $\pm 0.1 \text{ DIV}$  of the 8 DIV point on the vertical axis of the CRT screen. If they are not, adjust CHR Y POSI (RV22) on board A4 shown in Fig. 4-17.

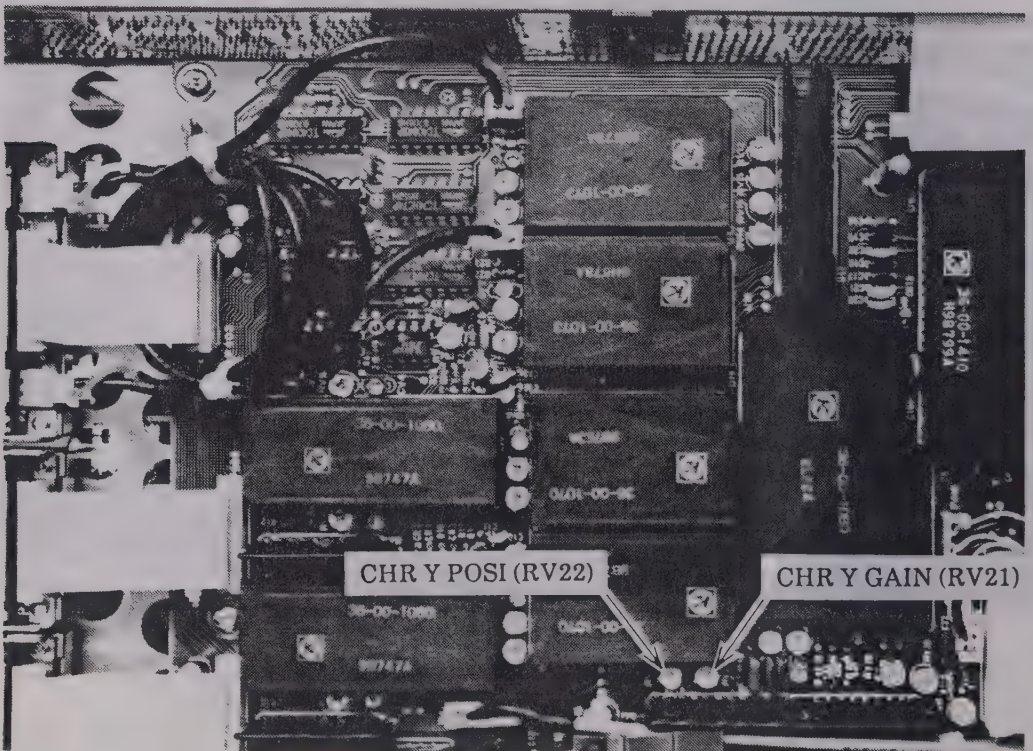


Fig. 4-17 Adjustment positions of CHR Y GAIN (RV21) and CHR Y POSI (RV22)

#### 4-4-4 Vertical Circuit

##### 1) ADD BALANCE

- (1) Perform initial setting of this oscilloscope in accordance with Table 4-3.
- (2) Press the "CH2" "VERT MODE" switch to put the oscilloscope into the dual trace mode.
- (3) Accurately align the traces of CH1 and CH2 with the center of the oscilloscope.
- (4) Set "VERT MODE" to "ADD", and confirm that the position of the ADD trace is within  $\pm 0.5$  divisions with respect to CH1 and CH2. If it is not, adjust ADD BAL (RV20) on board A4 shown in Fig. 4-18.

##### 2) CH1 SIGNAL OUT OFFSET

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Set the input coupling of CH1 to "GND".
- (3) Connect the CH1 SIGNAL OUTPUT to the CH2 input terminal, using coaxial cable. (Do not terminate it in 50ohms.)
- (4) Press the "CH2" "VERT MODE" switch and move the CH2 trace to the center of the CRT screen. (It is recommended that CH1 be turned OFF.)
- (5) Switch the input coupling of CH2 through "DC"  $\Rightarrow$  "GND"  $\Rightarrow$  "DC", and confirm that the trace on the CRT screen does not move more than 1 DIV. If it does, adjust CH1 SIGNAL OUT (RV18) on board A4 shown in Fig. 4-18.

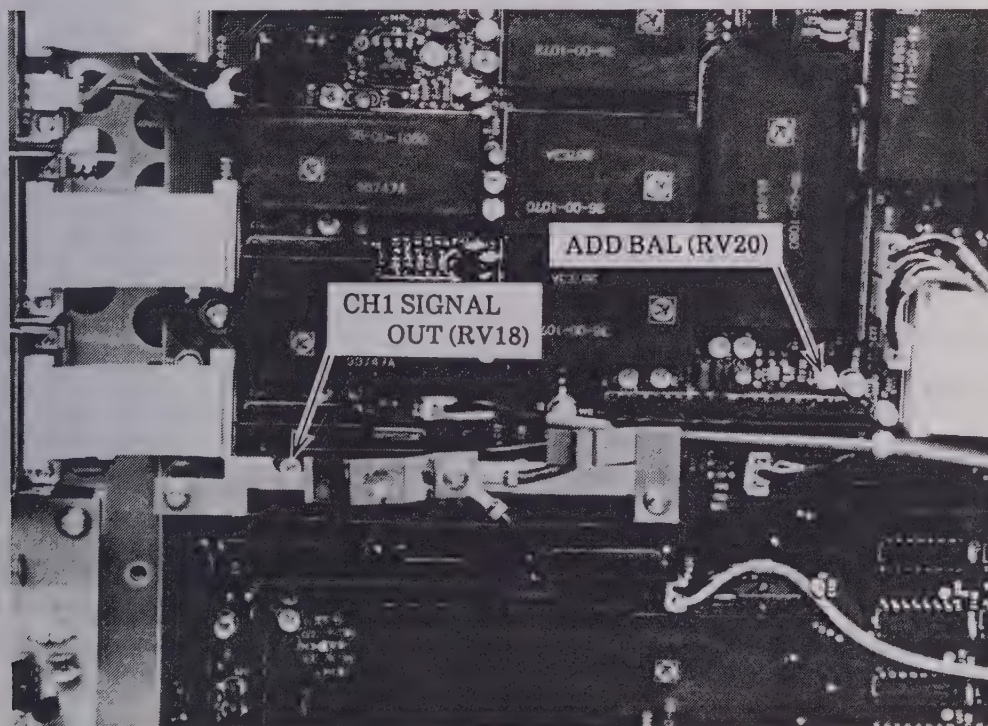


Fig. 4-18 Adjustment position of ADD BAL (RV20), and CH1 SIGNAL OUT (RV18)



### 3) CH3 POSITION CENTER

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Press the "CH3" "VERT MODE" switch to display the trace of CH3 on the CRT screen.  
(It is recommended that CH1 be turned OFF.)
- (3) Confirm that when the dot on the CH3 POSITION knob is set to the 12 O'clock position, the CH3 trace is at the center of the CRT screen. If it is not, adjust CH3 POSITION CENTER (RV14) on board A4 shown in Fig. 4-19.

### 4) CH4 POSITION CENTER

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Press the "CH4" "VERT MODE" switch to display the trace of CH4 on the CRT screen.  
(It is recommended that CH1 be turned OFF.)
- (3) Confirm that when the dot on the CH4 POSITION knob is set to the 12 O'clock position, the CH4 trace is at the center of the CRT screen. If it is not, adjust CH4 POSITION CENTER (RV15) on board A4 shown in Fig. 4-19.

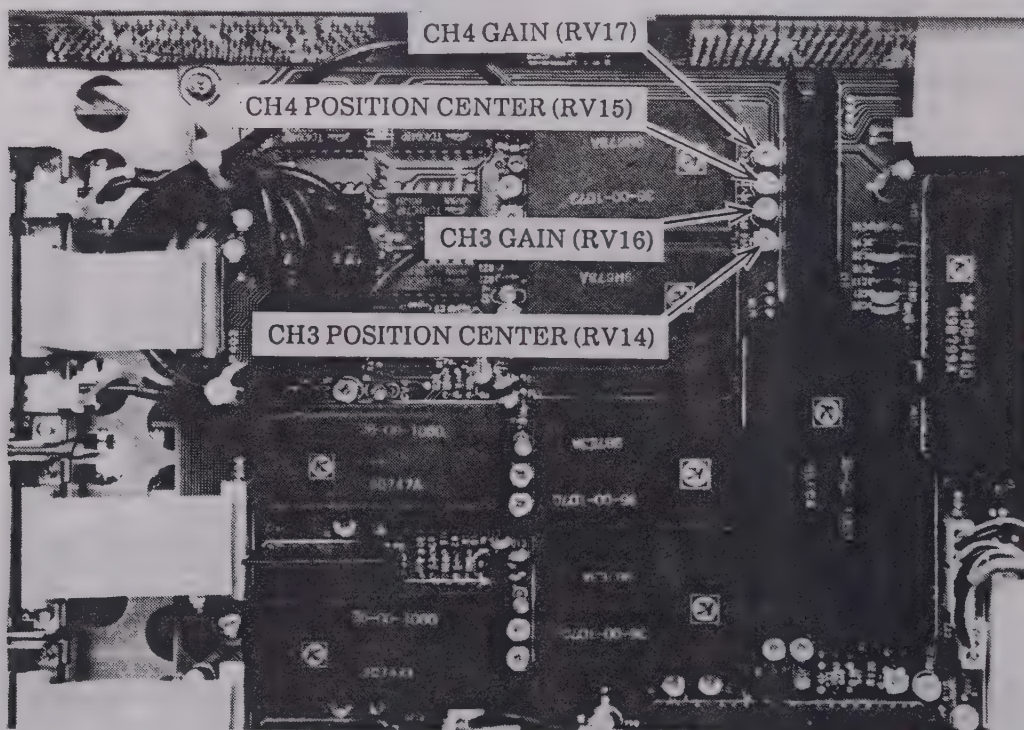


Fig. 4-19 Adjustment positions of CH3 and CH4 POSITION CENTER (RV14 and RV15)  
Adjustment position of CH3 GAIN (RV16) and CH4 GAIN (RV17)

## 5) CH3 GAIN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Select "VERT MODE" switch to have only CH3 display.
- (3) Set the input coupling of CH3 to "DC", and the input deflection factor to 0.1V ("GND" OFF).
- (4) Set "TIME / DIV" to 1 ms / DIV.
- (5) Connect the amplitude calibration signal output of the vertical axis calibrator which has been set to 0.5Vp-p, to the input of CH3 (unterminated), and confirm that the amplitude in the vertical direction is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust CH3 GAIN (RV16) on board A4 shown in Fig. 4-19.

## 6) CH4 GAIN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Select "VERT MODE" switch to have only CH4 display.
- (3) Set the input coupling of CH4 to "DC", and the input deflection factor to 0.1V. ("GND" OFF).
- (4) Set "TIME / DIV" to 1ms / DIV.
- (5) Connect the amplitude calibration signal output of the vertical axis calibrator which has been set to 0.5Vp-p, to the input of CH4 (unterminated), and confirm that the amplitude in the vertical direction is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust CH4 GAIN (RV17) on board A4 shown in Fig. 4-19.

## 7) CH1 and CH2 input attenuator (ATT)

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Connect the fast rise square wave of 10kHz from the vertical axis calibrator to the input terminal of CH1 (terminated in 50 ohms), and set "TIME / DIV" of the oscilloscope to 0.5ms / DIV.
- (3) Set the oscilloscope to each range of CH1 shown in Table 4-9, and confirm that the flatness of the square waves when the amplitude of the waveform on the CRT screen is 6 DIV, is within  $\pm 3\%$ . If it is not, adjust the CH1 phase compensator (C5, C8, and RV1) on board CH1-ATT shown in Fig. 4-21.
- (4) Press the "CH2" "VERT MODE" switch to put the oscilloscope into the dual trace mode, and connect the signal output to CH2.



- (5) Using exactly the same method as described in (3), check the flatness characteristics of the square wave for CH2 as well.
- (6) Connect a capacitance meter to the input terminal of CH1.
- (7) Set the deflection factor of CH1 to 10mV, and confirm that the input capacitance is  $20\text{pF} \pm 3\text{pF}$ . (The input capacitance is based on the 10mV range is 21pF, adjust the input capacitance of the 0.1V and 1V ranges to 21pF. Do likewise for CH2.)  
Confirm that the input capacitance of each range of CH1 shown in Table 4-9 is within  $\pm 1\text{pF}$  compared to the input capacitance of the 10mV range. If it is not, adjust the CH1 input capacitance (C4, C7) on board CH1-ATT shown in Fig. 4-21.
- (8) Connect the input of the capacitance meter to CH2.
- (9) Using exactly the same method as described in (7), check and adjust the input capacitance of CH2 as well.

|       |                    | RANGE |           |         |     |
|-------|--------------------|-------|-----------|---------|-----|
|       |                    | 1 m V | 1 0 m V   | 0 . 1 V | 1 V |
| C H 1 | Phase compensation | RV1   | —         | C5      | C8  |
|       | Input capacitance  | —     | Reference | C4      | C7  |
| C H 2 | Phase compensation | RV1   | —         | C5      | C8  |
|       | Input capacitance  | —     | Reference | C4      | C7  |

Table 4-9 Adjusting CH1 / CH2 input attenuator (ATT)

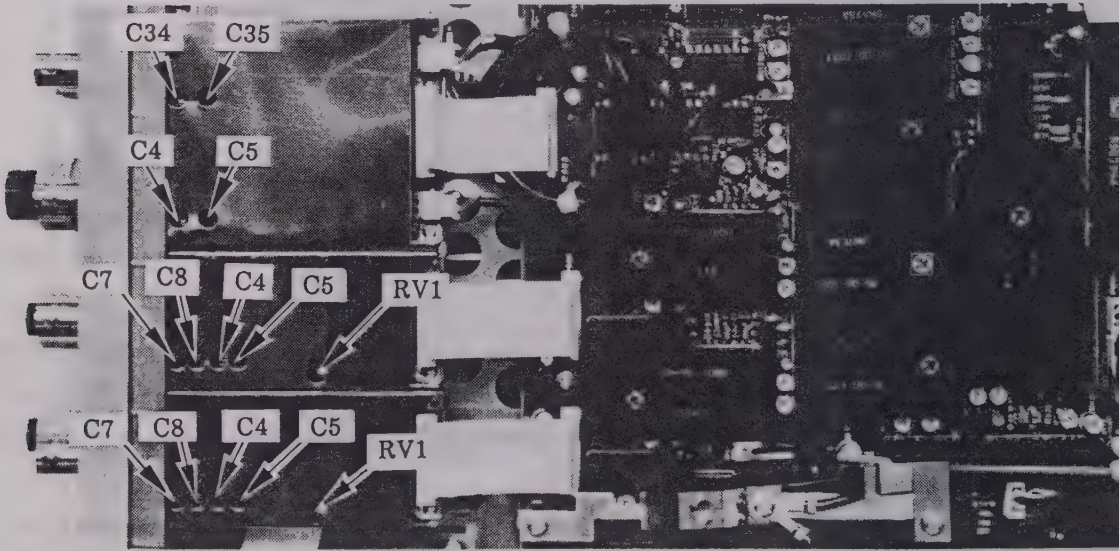


Fig. 4-21 Adjustment position of input attenuator (ATT)

8) CH3 and CH4 input attenuators (ATT)

- (1) Perform initial setting in accordance with Table 4-3.
  - (2) Press the “CH3” and “CH4” “VERT MODE” switches. Turn “CH1” OFF and turn CH3 and CH4 ON (dual trace mode).
  - (3) Set the deflection factor of CH3 and CH4 to 0.1V.
  - (4) Set “TIME / DIV” of the oscilloscope to 0.5ms / DIV.
  - (5) Connect the fast rise square wave of about 10kHz from the vertical axis calibrator to the input terminal of CH3 (terminated in 50ohms), and adjust the signal output to 6 DIV.
  - (6) Confirm that the flatness characteristics of the square wave are within  $\pm 3\%$ . The flatness characteristics of the 0.1V range constitute the reference for the CH3 amplifier. If the flatness is not within  $\pm 3\%$ , replace the CH3 / CH4 - ATT unit.
  - (7) Set the deflection factor of CH3 to 0.5V.
  - (8) Adjust the amplitude of the waveform on the CRT screen to 6 DIV.
  - (9) Confirm that the flatness characteristics of the square wave on the CRT screen are within  $\pm 3\%$ . If they are not, adjust the CH3 phase compensator (C5) on the CH3 / CH4 - ATT board shown in Fig. 4-21.
  - (10) Connect the fast rise square wave signal to CH4.
  - (11) Using exactly the same method as described in (5) to (9), check and adjust the square wave characteristics of CH4 as well.
  - (12) Connect a capacitance meter to the input terminals of CH3.
  - (13) Set the deflection factor of CH3 to 0.1V, and confirm that the input capacitance is  $20\text{pF} \pm 3\text{pF}$ . (The input capacitance of the 0.1V range constitutes a reference. For example, if the input capacitance of the 0.1V range is 21pF, adjust the input Capacitance of the 0.5V range to 21pF. Do likewise for CH4.)
- Confirm that the input capacitance of each range of CH3 shown in Table 4-9 is within  $\pm 1\text{pF}$  compared to the input capacitance of the 0.1V range. If it is not, adjust the CH3 input capacitance (C4) on board CH3 / CH4 - ATT shown in Fig. 4-21.
- (14) Connect the input of the capacitance meter to CH4.
  - (15) Using exactly the same method as described in (13), check and adjust the input capacitance of CH4 as well.

|     |                    | R A N G E |      |
|-----|--------------------|-----------|------|
|     |                    | 0.1V      | 0.5V |
| CH3 | Phase compensation | None      | C5   |
|     | Input capacitance  | Reference | C4   |
| CH4 | Phase compensation | None      | C35  |
|     | Input capacitance  | Reference | C34  |

Table 4-10 Adjustment of CH3 / CH4 input attenuator



### 9) Flat characteristics of square waves of CH1 and CH2

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Set "VERT MODE" to CH2 ONLY, and the input coupling of CH2 to "DC".
- (3) Set "A TIME/DIV" to 0.2 us/DIV.
- (4) Connect the fast rise square wave output of a vertical axis calibrator which has been set to about 1 MHz, to the CH2 input, and adjust the signal output to 5 DIV.
- (5) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 3\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV23, RV24, CV9, RV9, CV6, RV4 and CV3) on board A4, and also HIGH FREQUENCY COMPENSATION (RV1, RV2, RV5, CV1, CV2, and CV3) on board A5, shown in Figs.4-22 and 4-23.
- (6) Connect the signal output to CH1, and set "VERT MODE" to CH1 ONLY.
- (7) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 3\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV7, CV5, RV2, AND CV1) on board A4 showing in Fig.4-22.
- (8) SET "VOLTS/DIV" of CH1 to 5 mV/DIV.
- (9) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 3\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV3, CV2) on board A4 shown in Fig.4-22.

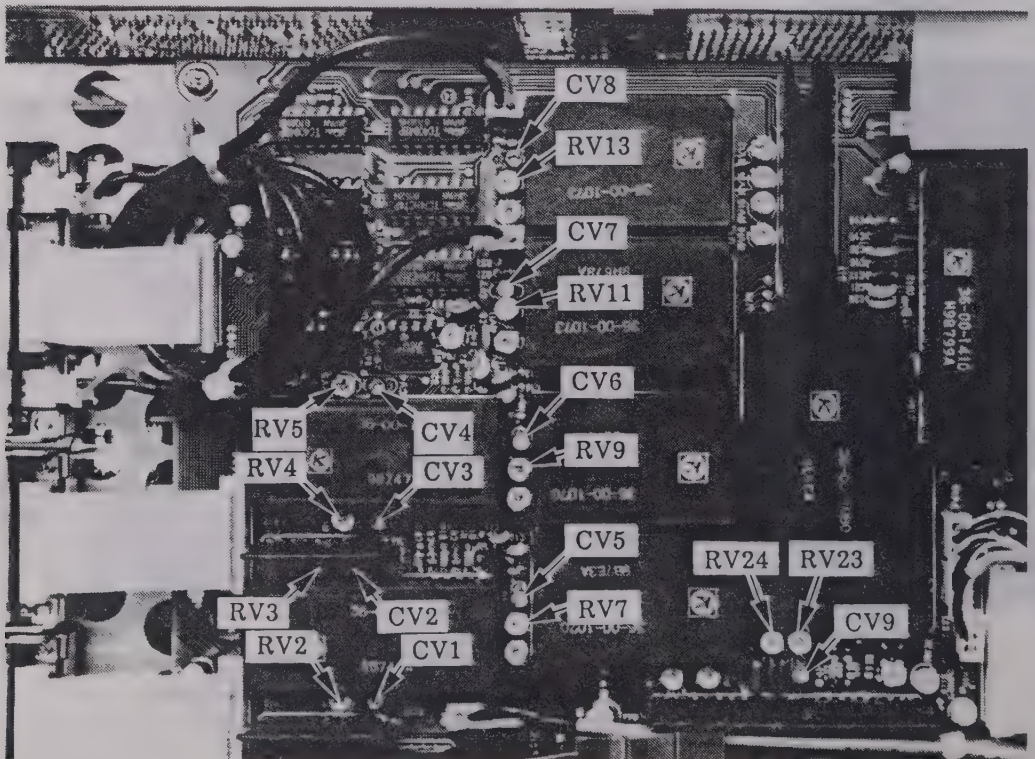


Fig. 4-22 Adjustment position of HIGH FREQUENCY COMPENSATION on board A4

- (10) Connect the signal output to CH2, and set "VERT MODE" to CH2 ONLY.
  - (11) Set "VOLTS/DIV" of CH2 to 5 mV/DIV.
  - (12) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 3\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV5, CV4) on board A4 shown in Fig.4-22.
- 10) Flat characteristics of square waves in CH3 and CH4**
- (1) Perform initial setting of the instrument in accordance with 4-3.
  - (2) Set "VERT MODE" to CH3 ONLY, and the input coupling of CH3 to "DC".
  - (3) Set " $\div 5$ " of CH3 to OFF.
  - (3) Set "A TIME/DIV" to 0.2us/DIV.
  - (4) Connect the fast rise square wave output of a vertical axis calibrator which has been set to about 1 MHz, to the CH3 input, and adjust the signal output so that the waveform on the screen is 5 DIV.
  - (5) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 5\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV11, CV7) of board A4 shown if Fig.4-22.
  - (6) Connect the signal output to CH4, and set "VERT MODE" to CH4 ONLY.
  - (7) Set " $\div 5$ " of CH4 to OFF.
  - (8) Confirm that the flat characteristics of the square waves, including overshoot and ringing, are within  $\pm 5\%$ . If they are not, adjust HIGH FREQUENCY COMPENSATION (RV13, CV8) on board A4 shown in Fig.4-22.

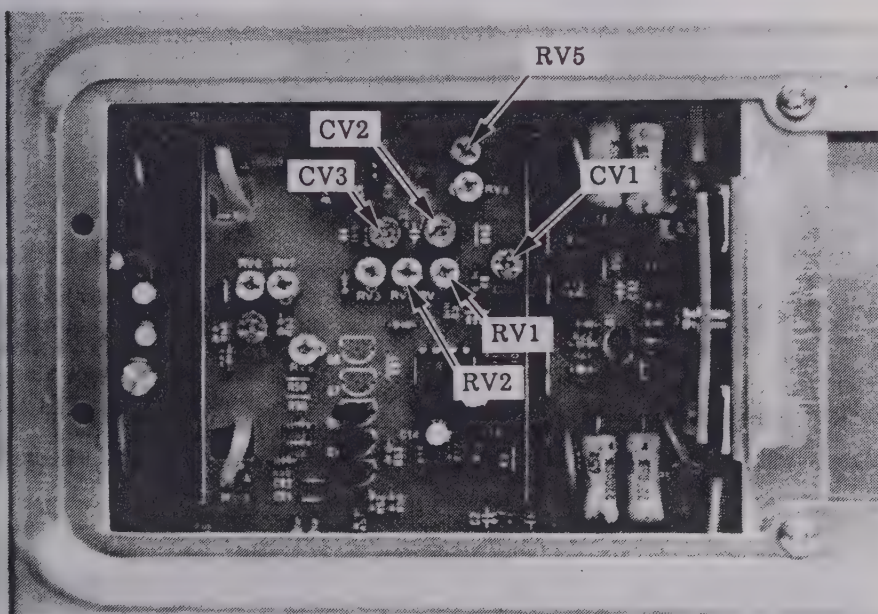


Fig. 4-23 Adjustment position of HIGH FREQUENCY COMPENSATION on board A5



#### 4-4-5 Checking and adjusting Trigger Circuit

##### 1) TRIG AUTO CENTER

- (1) Perform initial setting of the oscilloscope in accordance with Table 4-3.
- (2) Set the input coupling of CH1 to "AC".
- (3) Connect the output of a signal generator which has been set to about 50kHz, to the input terminal of CH1, and adjust the signal output so that the amplitude of the waveform on the CRT is 8 DIV.
- (4) Set "TIME / DIV" to  $5\mu\text{s} / \text{DIV}$ .
- (5) Confirm that the trigger point is at the center of the amplitude of the waveform. If it is not, adjust TRIG CENTER (1) (RV25) on board A4 shown in Fig. 4-24.
- (6) Set "TIME/DIV" to  $10\mu\text{s}/\text{DIV}$ .
- (7) Set "HORIZ MODE" to "B", and "B TIME/DIV" to  $5\mu\text{s}/\text{DIV}$ .
- (8) Set "DELAY TIME" to  $0.00\mu\text{s}$ , and "B TRIG'D" to ON.
- (9) Confirm that the trigger point is at the center of the amplitude of the waveform. If it is not, adjust TRIG CENTER (2) (RV26) on board A4 shown in Fig. 4-24.

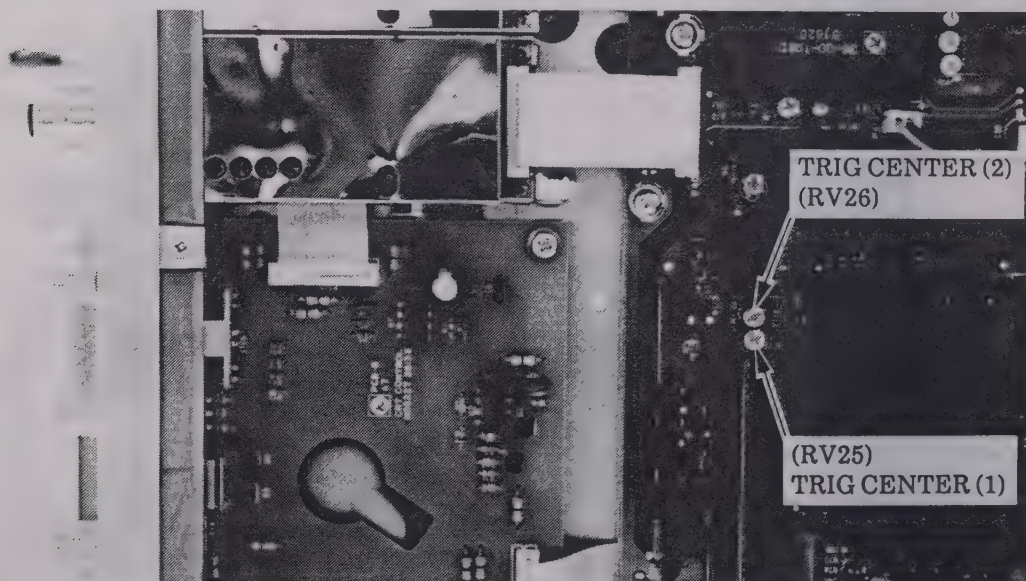


Fig. 4-24 Adjustment position of TRIG CENTER (1) (RV25) and TRIG CENTER (2) (RV26)

## 2) TRIG DC OFFSET

### ★ CH1 TRIG DC OFFSET

- (1) Perform initial setting of the oscilloscope in accordance with Table 4-3.
- (2) Set the input coupling of CH1 to "AC", and the input deflection factor to 0.1V.
- (3) Set "AUTO TRIG" to OFF.
- (4) Connect the output of a signal generator which has been set to about 50kHz, to the input terminal of CH1, and adjust the signal output so that the amplitude of the waveform on the CRT is 8 DIV.
- (5) Set "TIME / DIV" to  $5\mu\text{s} / \text{DIV}$ .
- (6) Adjust "TIME / DIV" so that the trigger point moves to the center of the amplitude of the waveform.
- (7) Confirm that when "TRIG COUPLING" is switched from "AC" to "DC", or vice-versa, the trigger point does not move at the center of the amplitude of the waveform. If it does, adjust CH1 TRIG OFFSET (RV6) on board A4 shown in Fig. 4-25.

### ★ CH2 TRIG DC OFFSET

- (1) Set "VERT MODE" to "CH2", and set the input deflection factor to 0.1V.
- (2) Set the input coupling of CH2 to "AC", and connect the signal output to CH2.
- (3) Set "TRIG COUPLING" to "AC", and adjust "TRIG LEVEL" so that the trigger point moves to the center of the amplitude waveform.
- (4) Confirm that when "TRIG COUPLING" is switched from "AC" to "DC", or vice-versa, the trigger point does not move at the center of the amplitude of the waveform. If it does, adjust CH2 TRIG OFFSET (RV8) on board A4 shown in Fig. 4-25.

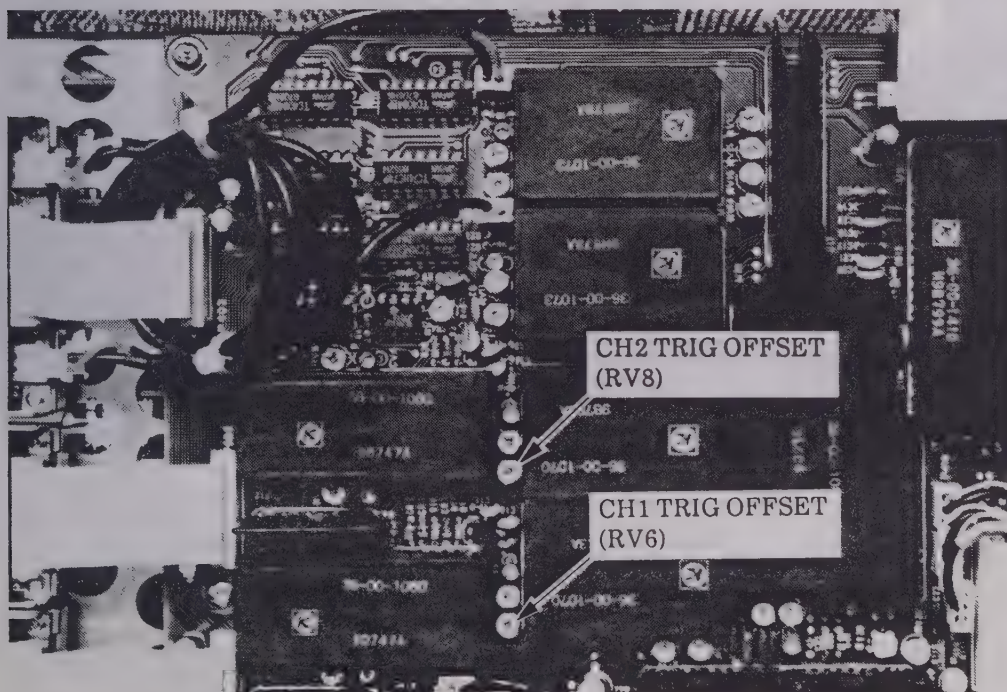


Fig. 4-25 Adjustment positions of CH1 and CH2 TRIG OFFSET (RV6 and RV8)



★ CH3 TRIG DC OFFSET

- (1) Set "VERT MODE" to "CH3", and set the input deflection factor to 0.1 V.
- (2) Set the input coupling of CH3 to "AC", and connect the signal output to CH3.
- (3) Set "TRIG COUPLING" to "AC", and adjust "TRIG LEVEL" so that the trigger point moves to the center of the amplitude of the waveform.
- (4) Confirm that when "TRIG COUPLING" is switched from "AC" to "DC", or vice-versa, the trigger point does not move at the center of the amplitude of the waveform. If it does, adjust CH3 TRIG OFFSET (RV10) on board A4 shown in Fig. 4-26.

★ CH4 TRIG DC OFFSET

- (1) Set "VERT MODE" to "CH4", and set the input deflection factor to 0.1 V.
- (2) Set the input coupling of CH4 to "AC", and connect the signal output to CH4.
- (3) Set "TRIG COUPLING" to "AC", and adjust "TRIG LEVEL" so that the trigger point moves to the center of the amplitude of the waveform.
- (4) Confirm that when "TRIG COUPLING" is switched from "AC" to "DC", or vice-versa, the trigger point does not move at the center of the amplitude of the waveform. If it does, adjust CH4 TRIG OFFSET (RV12) on board A4 shown in Fig. 4-26.

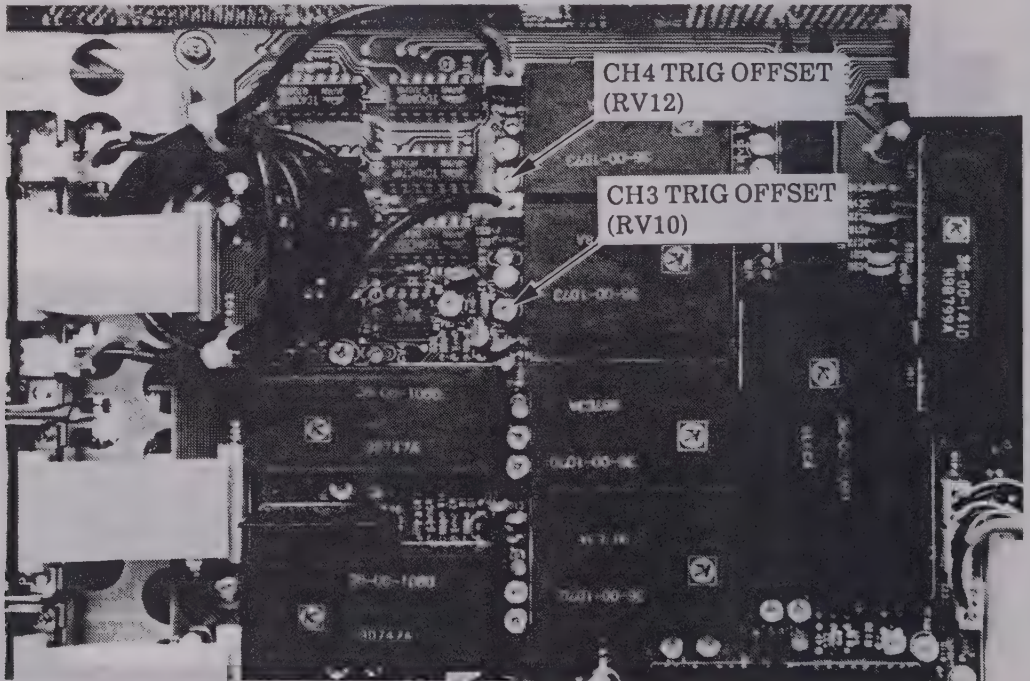


Fig. 4-26 Adjustment positions of CH3 and CH4 TRIG OFFSET (RV10 and RV12)

#### 4-4-6 Checking and adjusting horizontal circuit

##### 1) Comparator start

- (1) Perform initial setting of the oscilloscope in accordance with table 4-3.
- (2) Using the  $\Delta T$  function, set the value of  $\Delta T$  on the CRT screen to within "8.000 ms"  $\pm 0.04$ ms.
- (3) Set "HORIZ MODE" to "ALT", and "B TIME/DIV" to 10  $\mu$ s. (Set "B TRIG" to OFF.)
- (4) Set the input coupling of CH1 to "GND", then adjust the brightness of A and B so that the two bright spots (lines) on the CRT screen can be clearly observed.  
(See Fig. 4-27.)

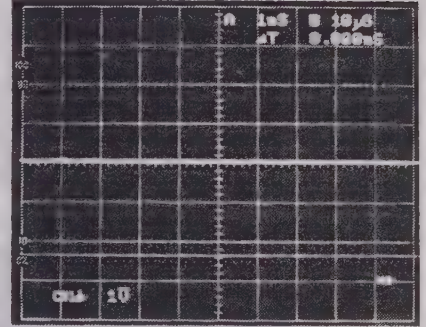


Fig. 4-27 Two bright spots (lines)

- (5) Confirm that the position between the two bright spots (lines) on the CRT screen is within  $8.0 \pm 0.1$  DIV.

If it is not, adjust COMP START ADJ (RV29) on board A4 shown in Fig. 4-28.

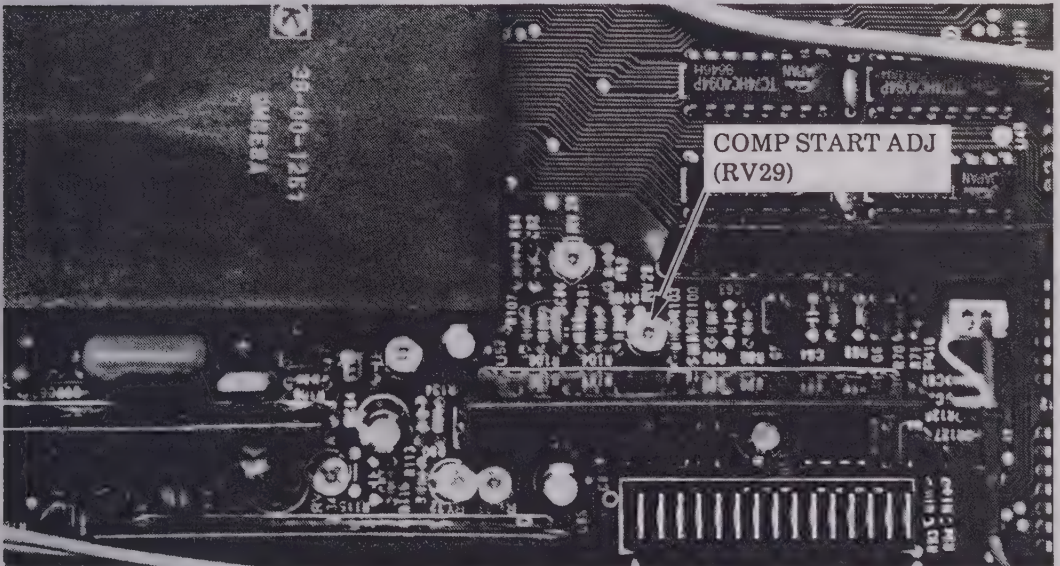


Fig. 4-28 Adjustment position of COMP START ADJ (RV29)



## 2) X-Y CENTER

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Accurately align the trace of CH1 with the center of the CRT screen.
- (3) Set "HORIZ MODE" to "X-Y".
- (4) Confirm that the bright spot is within  $\pm 1$  DIV from the center of the CRT screen. If it is not, adjust X POSITION (RV30) on board A4 shown in Fig. 4-29.

## 3) X-Y GAIN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Set the "HORIZ MODE" switch at X-Y mode.
- (3) Apply a 50mVpp calibration signal output to the CH1 input, and confirm that the amplitude in the horizontal direction is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust X-Y GAIN (RV31) on board A4 shown in Fig. 4-29.

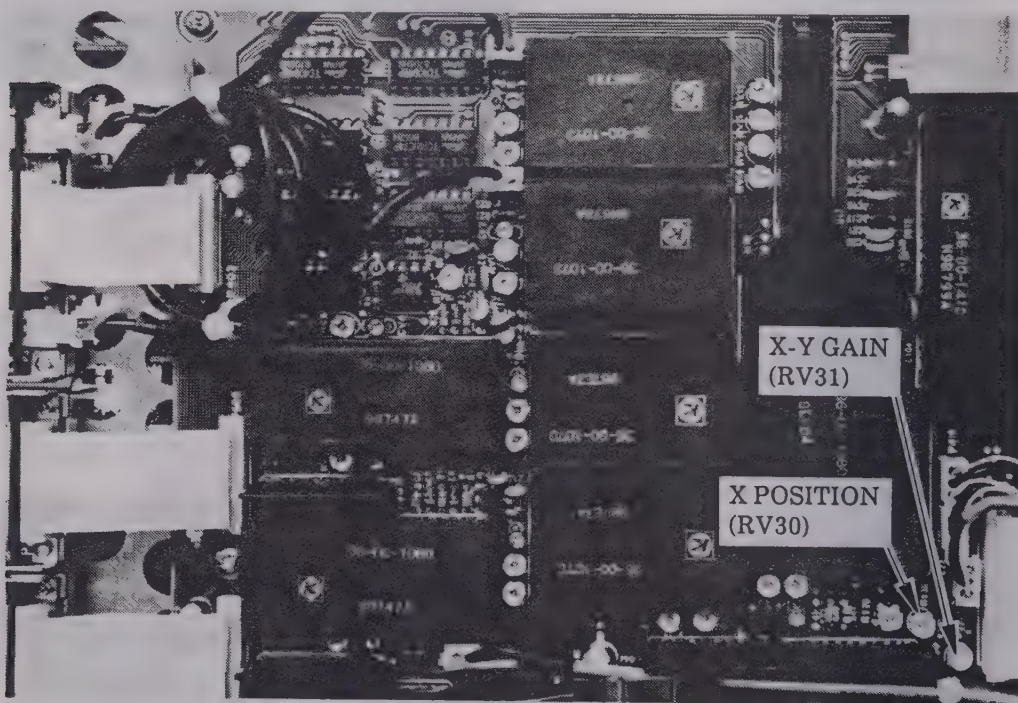


Fig. 4-29 Adjustment positions of X POSITION (RV30), and X-Y GAIN (RV31)

#### 4) SWEEP LENGTH

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Apply a 1ms time marker signal output, to the CH1 input (terminated in 50 ohms), and adjust the VOLT/DIV switch so that the amplitude of the waveform on the CRT screen is about 2 DIV.
- (3) Count the time markers and confirm that the sweep length is within  $11.5 \pm 0.5 \text{ DIV}$ . If it is not, adjust the A SWEEP LENGTH (RV27) on board A4 shown in Fig. 4-30.
- (4) Set "HORIZ MODE" to "ALT", and set "BTRG" to ON.
- (5) Set the B sweep to 1ms/DIV, and the A sweep to 2ms/DIV.
- (6) Set "DLY" to ON, and turn the "READ OUT" knob to the left to set the DELAY TIME POSITION to 0.
- (7) Set "HORIZ MODE" to "B".
- (8) Count the timer markers and confirm that the sweep length is within  $11.5 \pm 0.5 \text{ DIV}$ . If it is not, adjust the B SEEP LENGTH (RV28) on board A4 shown in Fig. 4-30.

#### 5) Horizontal axis $\times 10 \text{ MAG GAIN}$

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Connect a 0.1ms time marker signal, to the CH1 input (terminated in 50 ohms), and adjust the input factor so that the amplitude of the waveform on the CRT screen is about 2 DIV.
- (3) Set " $\times 10 \text{ MAG}$ " to ON.
- (4) Confirm that the sweep accuracy is within  $\pm 4\%$ . If it is not, adjust  $\times 10 \text{ MAG GAIN}$  (RV34) on board A4 shown in Fig. 4-30.

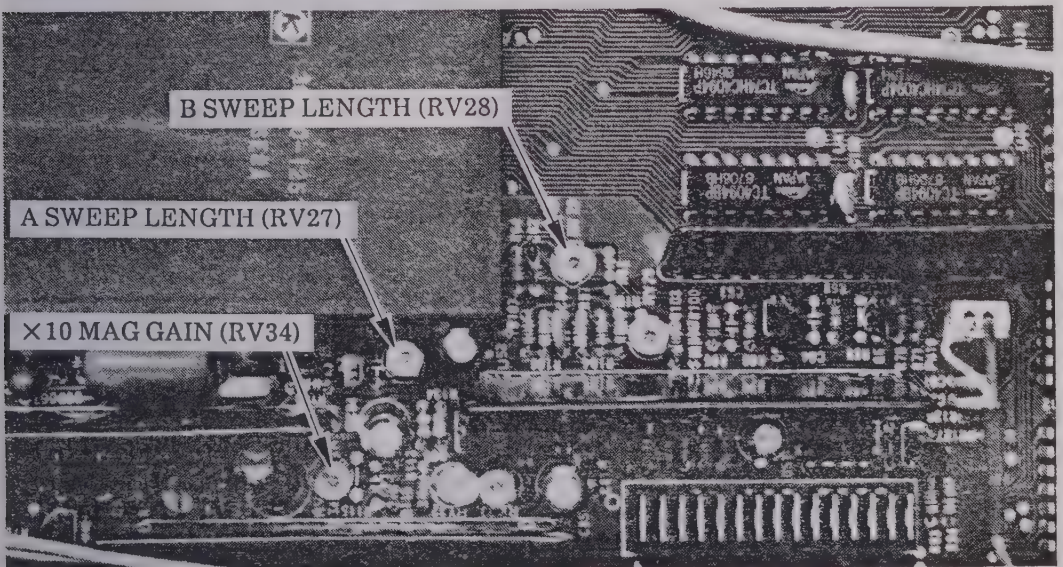


Fig. 4-30 Adjustment positions of A and B SWEEP LENGTH (RV27 and RV28) and  $\times 10 \text{ MAG GAIN}$  (RV34)



#### 4-4-7 Checking and adjusting DVM COMPEN

- (1) Perform initial setting in accordance with Table 4-3.
- (2) Apply 1MHz fast rise signal to the input of CH1 (terminated in 50ohms), and adjust the signal output to 6 DIV.
- (3) Connect the oscilloscope to pin 16 of U21 on board A4 shown in Fig. 4-31, and adjust the deflection factor of the oscilloscope so that the amplitude of the waveform on the CRT screen is  $5 \text{ DIV} \pm 0.2 \text{ DIV}$ .
- (4) Confirm that the aberrations of the waveform is within  $\pm 3\%$ . If it is not, adjust DVM COMPEN (RV19) on board A4 shown in Fig. 4-32.

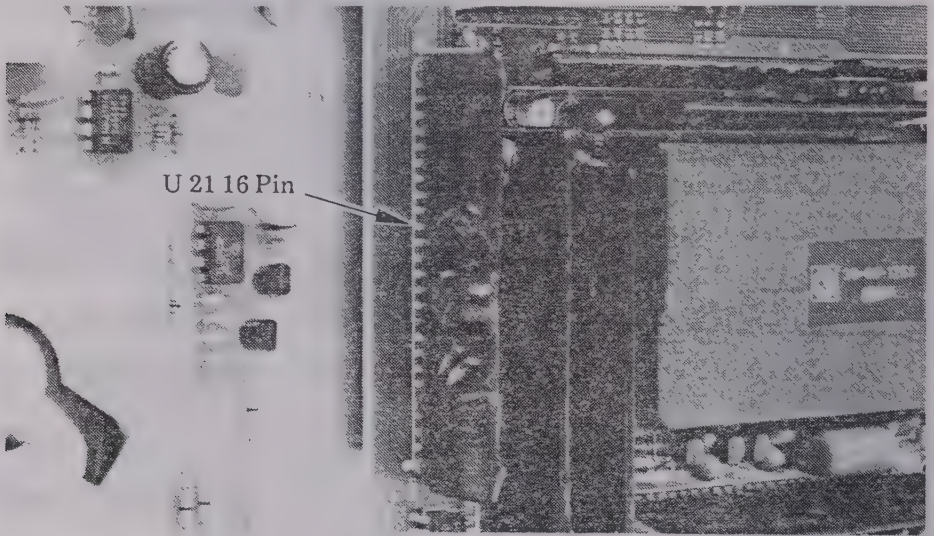


Fig. 4-31 Connection position of oscilloscope (pin 16 of U21)

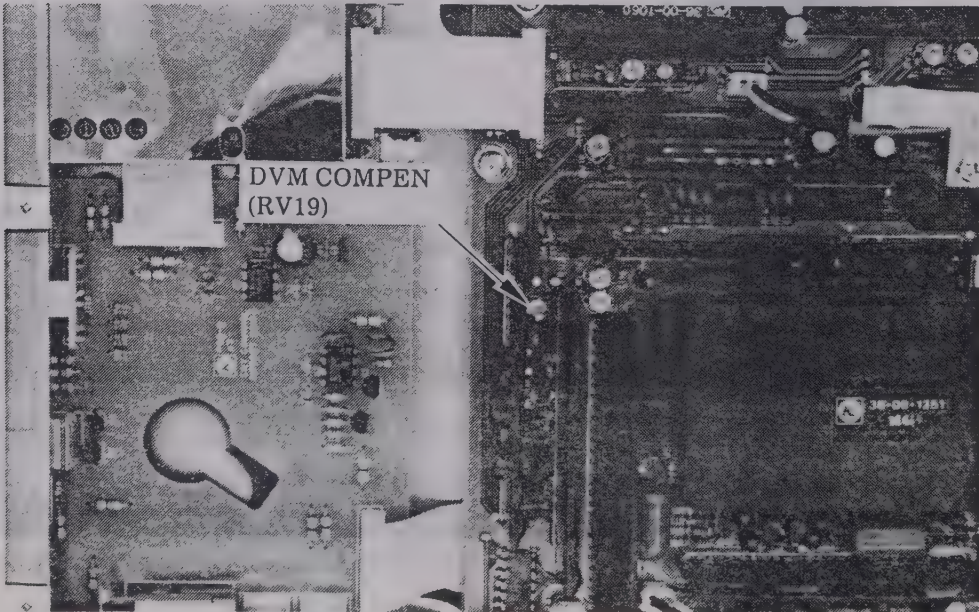


Fig. 4-32 Adjustment position of DVM COMPEN (RV19)

4-4-8 Checking and adjusting storage system

**Caution**

*Before checking the storage system, confirm that the real time system has been checked and adjusted. If it has not, be sure to check and adjust it before adjusting the storage system.*

**1) Method of displaying service waveform**

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Align the starting point of the sweep with the first graticule at the left of the CRT screen.
- (3) Set "STORAGE/REAL" to "STORAGE".
- (4) Short the self check short pin on the A8 MAIN CPU board shown in Fig.4-33. By simultaneously pressing the 2nd function key and the "SAVE" key indicated in Fig. 4-34, the service waveform shown in Fig.4-35 will be displayed.

Note: To cancel the service waveform, press "A" of "HORI.MODE".



Fig. 4-33 Self check short pin (A8 MAIN CPU board)

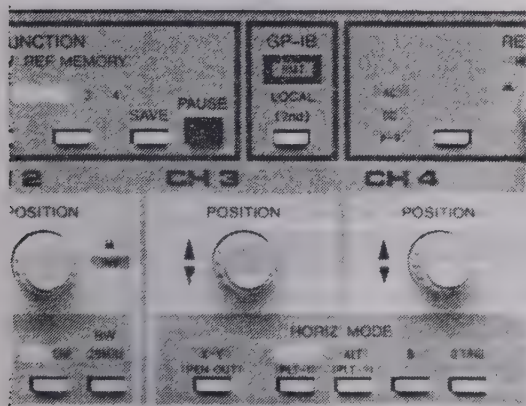


Fig. 4-34 2nd function key and SAVE key

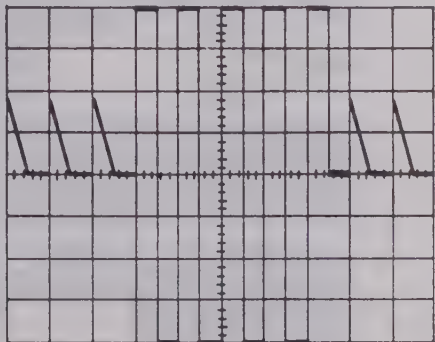


Fig. 4-35 Service waveform



## 2) Sweep position

- (1) Perform initial switching of the instrument in accordance with Table 4-3.
- (2) Align the starting point of the sweep with the first graticule at the left of the CRT screen. (Do not change this setting.)
- (3) Confirm that when "STORAGE/REAL" is set to "STORAGE", the starting of the sweep is within  $\pm 0.1$  DIV with the first graticule at the left edge. If it is not, adjust SWEEP START (RV5) on board A18 shown in Fig. 4-37.

## 3) Sweep gain

- (1) Display the service waveform. [For details, see 1).]
- (2) Confirm that the clearance between A and B shown in Fig. 4-36 (2nd and 9th graticule) is within  $8 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust SWEEP GAIN (RV4) on board A18 shown in Fig. 4-37.

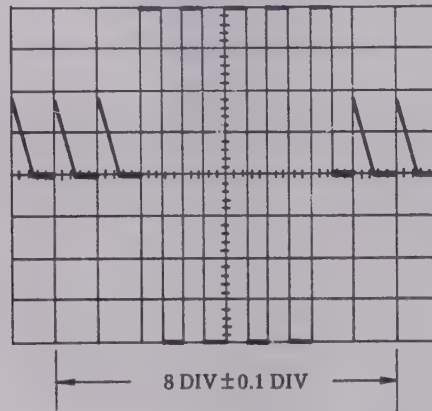


Fig. 4-36 AdjustING sweep gain

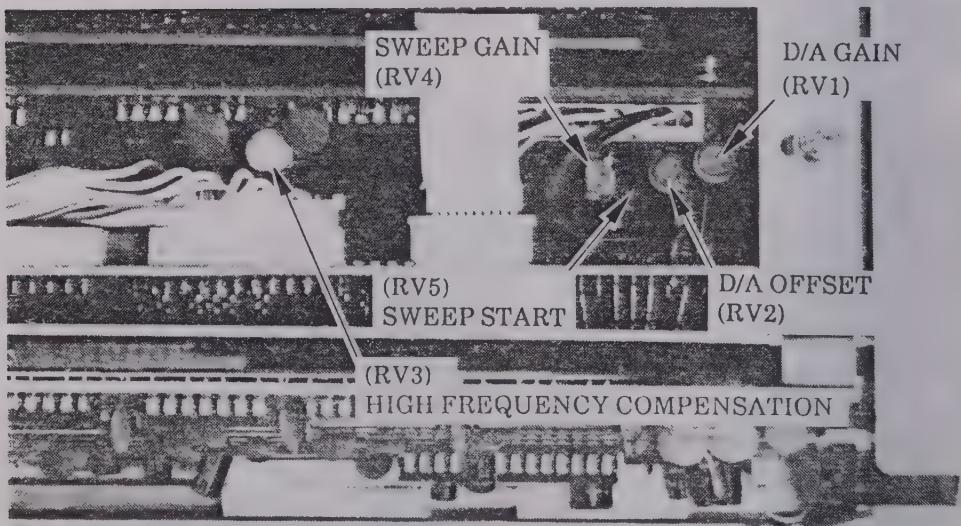


Fig. 4-37 Adjustment position of D/A GAIN (RV1), D/A OFFSET (RV2), HIGH FREQUENCY COMPENSATION (RV3), SWEEP GAIN (RV4) and SWEEP START (RV5)

#### 4) Vertical gain

- (1) Display the service waveform. [For details, see 1).]
- (2) Confirm that the amplitude of the square wave portion of the service waveform is within  $8 \text{ DIV} \pm 0.1 \text{ DIV}$ , as shown in Fig.4-38. If it is not, adjust D/A GAIN (RV1) on board A18 shown in Fig. 4-37.

#### 5) Vertical POSITION

- (1) Display the service waveform. [For details, see 1).]
- (2) Confirm that the vertical position of the service waveform is at the center of the CRT, as shown in Fig. 4-38. If it is not, adjust D/A OFFSET (RV2) on board A18 shown in Fig.4-37.

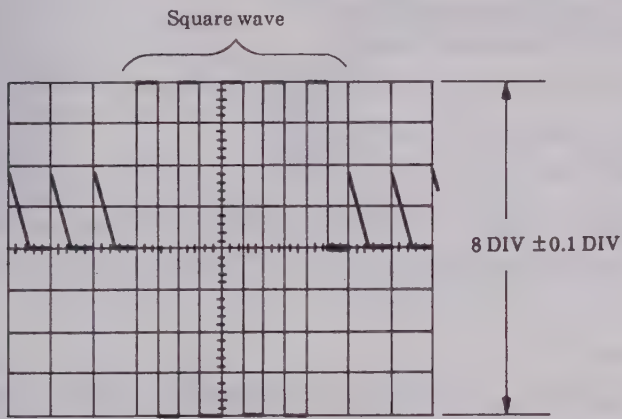


Fig. 4-38 Adjusting vertical position and gain

#### 6) High frequency compensation

- (1) Display the service waveform. [for details, see 1).]
- (2) Confirm that the high frequency characteristics of the square wave portion of the service waveform (see Fig.4-39) are flat. If they are not, adjust HIGH FREQUENCY COMPENSATION (RV3) on board A18 shown in Fig.4-37.

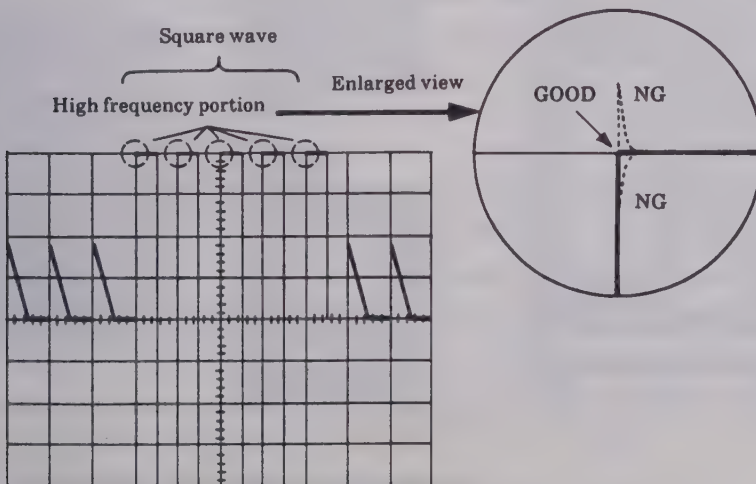


Fig. 4-39 High frequency portion of square wave

## 7) CH1 A/D GAIN

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Apply a 50mVp-p standard amplitude generator output to the CH1 input. (If the sweep speed is not suitable, select another sweep speed.)
- (3) Confirm that the amplitude displayed on the screen is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . (If it is not, return to the real time system adjustment and re-adjust.)
- (4) Set "STORAGE/REAL" to "STORAGE".
- (5) Confirm that the amplitude is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust CH1 A/D GAIN (RV1) on board A16 shown in Fig.4-40.

## 8) CH1 A/D OFFSET

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Set the input coupling of CH1 to "GND".
- (3) Rotate "CH1 POSITION" knob until the trace of CH1 is at the center of the CRT screen.
- (4) Set "STORAGE/REAL" to "STORAGE", and confirm that the trace shift is within  $\pm 0.1 \text{ DIV}$ . If it is not, adjust CH1 A/D OFFSET (RV2) on board A16 shown in Fig. 4-40.

## 9) CH2 A/D GAIN

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Set "VERT MODE" to "CH2".
- (3) Apply a 50mVp-p standard amplitude generator output to the CH2 input. (If the sweep speed is not suitable, select another sweep speed.)
- (4) Confirm that the amplitude in the vertical direction of the CRT screen is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . (If it is not, return to the real time system adjustment and re-adjust the system.)
- (5) Set "STORAGE/REAL" to "STORAGE".
- (6) Confirm that the amplitude in the vertical direction of the CRT screen is within  $5 \text{ DIV} \pm 0.1 \text{ DIV}$ . If it is not, adjust CH1 A/D GAIN (RV3) on board A16 shown in Fig. 4-40.

## 10) CH2 A/D OFFSET

- (1) Perform initial setting of the instrument in accordance with Table 4-3.
- (2) Set "VERT MODE" to "CH2".
- (3) Set the input coupling of CH2 to "GND".
- (4) Rotate "CH2 POSITION" knob until the trace of CH2 is at the center of the CRT screen.
- (5) Set "STORAGE/REAL" to "STORAGE", and confirm that the trace shift is within  $\pm 0.1 \text{ DIV}$ . If it is not, adjust CH2 A/D OFFSET (RV4) on board A16 shown in Fig. 4-40.



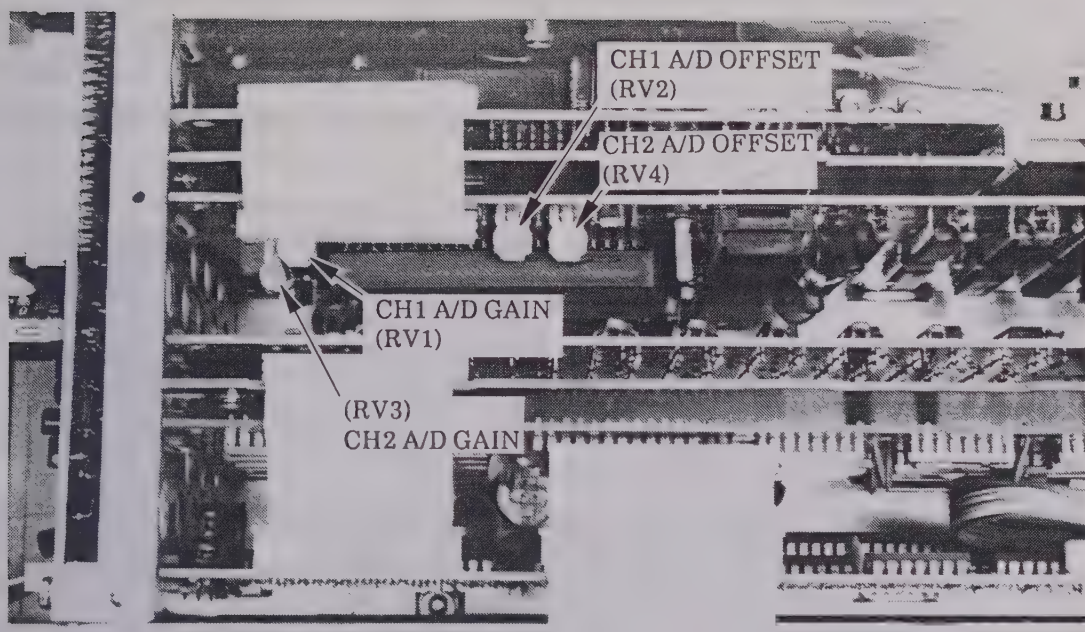


Fig. 4-40 Adjustment positions of CH1 GAIN (RV1) and CH1 A/D OFFSET (RV2)  
Adjustment positions of CH2 A/D GAIN (RV3) and CH2 A/D OFFSET (RV4)

#### 11) 2 $\mu$ s GAIN BAL.

- (1) Turn off the power switch, and remove the bracket shown in Fig. 4-41.
- (2) Slacken the outer frame of connector P1053, and remove the flat cable.
- (3) Remove board A15 from the chassis, and place it on the unit with an insulating sheet beneath it.
- (4) Insert the end of the flat cable into connector P1053.

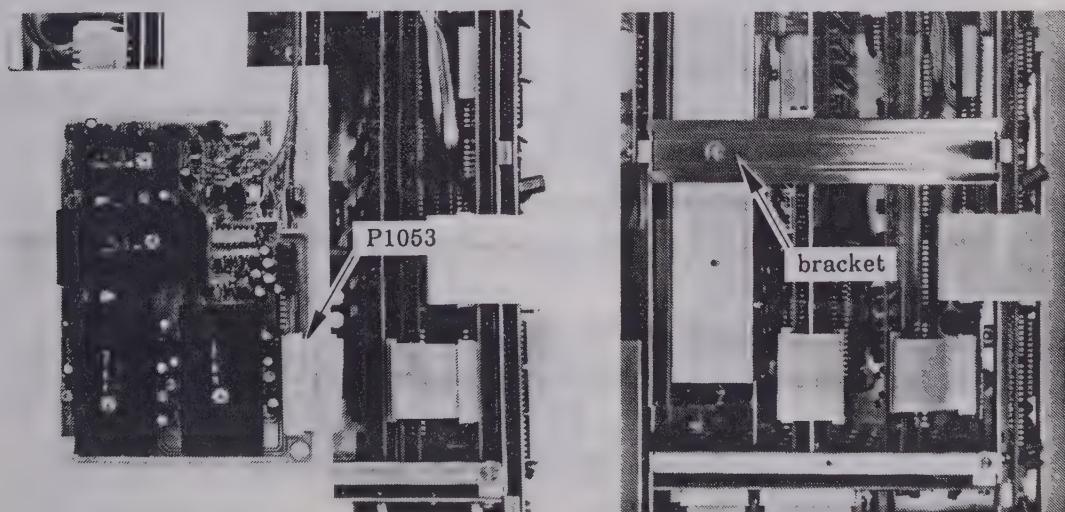


Fig. 4-41 Positions of BRACKET and CONNECTOR (P1053)

- (5) Perform initial setting of the instrument in accordance with Table 4-3.



- (6) Apply a 50kHz sin wave from constant amplitude generator to CH1 input, and adjust the signal output so that the waveform on the CRT screen is 6 DIV.
- (7) Set "TIME/DIV" to  $2\mu\text{s}/\text{DIV}$ , and set "STORAGE/REAL" to "STORAGE".
- (8) Confirm that a clean sine wave appears on the CRT screen, as shown in Fig. 4-42 (A). If the waveform contains a chopped component, as shown in Fig. 4-42 (B) adjust CH1 GAIN ADJ (RV1) on board A15 shown in Fig. 4-44.
- (9) Set "VERT MODE" to CH2 ONLY, and connect the signal output to CH2.
- (10) Confirm that a clean sine wave appears on the CRT as shown in Fig. 4-42 (A). If the waveform contains a chopped component as shown in Fig. 4-42 (B) adjust CH2 GAIN ADJ (RV2) on board A15 shown in Fig. 4-44.
- (11) Turn off the power switch, and reinstall the board.

(When proceeding to the next sub-section, it is permissible to leave board A15 as is and start from step (5) of the next sub-section.)

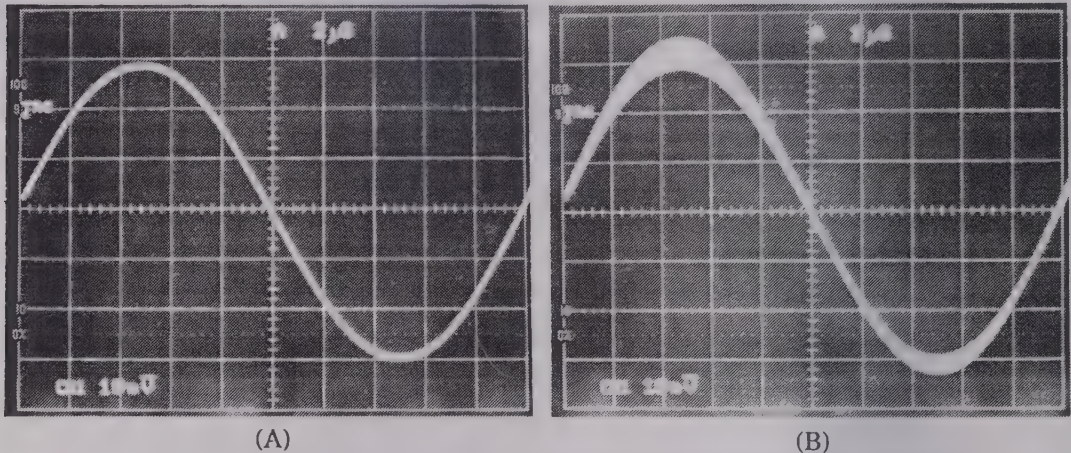


Fig. 4-42 Storage waveform obtained when adjusting  $2\mu\text{s}$  sweep

## 12) CH1/CH2 envelope gain

When checking the gain continuing on from the previous sub-section, start from step (5).

- (1) Turn off the power switch, and remove the bracket shown in Fig. 4-41.
- (2) Slacken the outer frame of connector P1053, and remove the flat cable.
- (3) Remove board A15 from the chassis, and place it on the unit with an insulating sheet beneath it.
- (4) Insert the end of the flat cable into connector P1053.
- (5) Perform initial setting of the instrument in accordance with Table 4-3.
- (6) Apply a  $50\text{mVp-p}$  standard amplitude generator output to the CH1 input.
- (7) Set "TIME/DIVE" to  $0.2\text{ns}/\text{DIV}$ , and set "STORAGE/REAL" to "STORAGE".
- (8) Set "ENV" (envelope) to "ON".
- (9) Confirm that a clean sine wave appears on the CRT screen, as shown in Fig. 4-43 (A). If the waveform contains a noise component as shown in Fig. 4-43 (B) adjust CH1 BOTTOM GAIN (RV6) and also CH1 PEAK GAIN (RV5) on board A15 shown in Fig. 4-44.

- (10) Set "TIME/DIV" TO CH2 ONLY, and connect the signal output to CH2.
- (11) Like CH1, confirm that the waveform on the CRT screen is clean as shown in Fig. 4-43 (A).

If the waveform contains noise as shown in Fig. 4-43(B), adjust CH2 BOTTOM GAIN (RV4) and CH2 PEAK GAIN (RV3) on board A15 shown in Fig. 4-44 so that the amplitude of the waveform is  $5\text{ DIV} \pm 0.1\text{ DIV}$

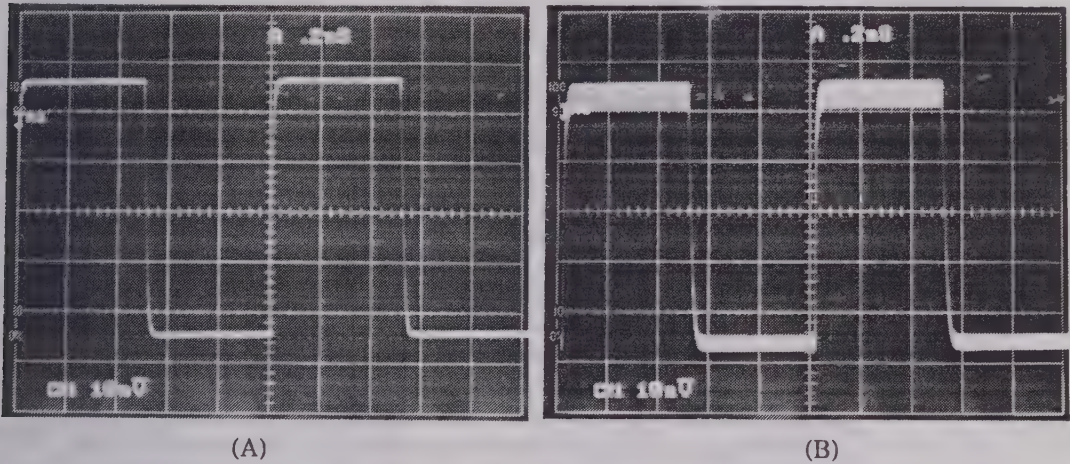


Fig. 4-43 Waveform when adjusting envelope gain

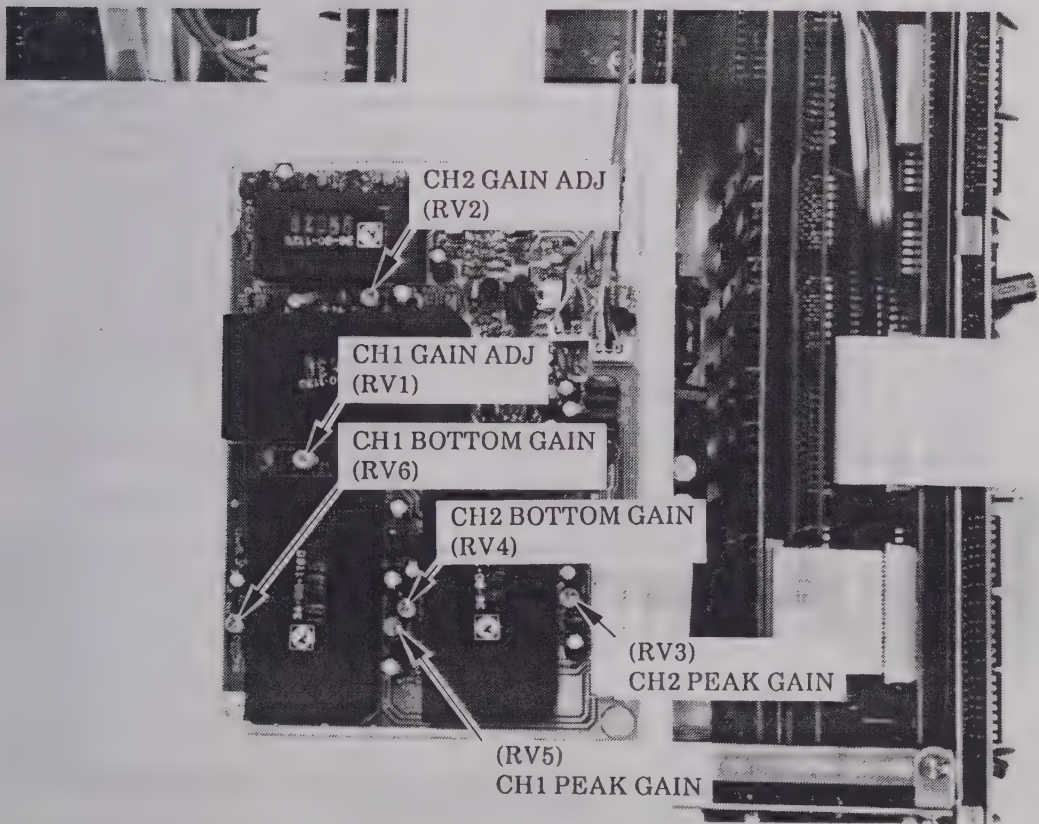


Fig. 4-44 Adjustment positions of CH1 GAIN ADJ (RV1) and CH2 GAIN ADJ (RV2), CH1 BOTTOM GAIN (RV6), CH1 PEAK GAIN (RV5). CH2 BOTTOM GAIN (RV4) and CH2 PEAK GAIN (RV3)



#### 4-4-9 Adjustment Table

Adjustment Items are shown in Table 4-11 to 4-12.

| Item             | Adjustment                  | Adjustment name     | Circuit No. | Board    |
|------------------|-----------------------------|---------------------|-------------|----------|
| Power Supply     | Power supply voltage        | + 12V ADJ           | RV1         | A12      |
|                  | Reference voltage           | V REF 30mV          | RV1         | A4       |
| CRT Circuit      | CRT system                  | GEOMETRY            | RV4         | A6       |
|                  |                             | ASTIG               | RV5         | A6       |
|                  |                             | SUB FOCUS           | RV3         | A6       |
|                  |                             | HALATION            | RV6         | A6       |
|                  |                             | CRT BIAS            | RV2         | A6       |
|                  |                             |                     |             |          |
|                  | Charactor gain (X)          | CHR X GAIN          | RV33        | A4       |
|                  | Charactor position (X)      | CHR X POSI          | RV32        | A4       |
| Vertical Circuit | Charactor gain (Y)          | CHR Y GAIN          | RV21        | A4       |
|                  | Charactor position (Y)      | CHR Y POSI          | RV22        | A4       |
|                  | ADD Balance                 | ADD BALANCE         | RV20        | A4       |
|                  | CH1 signal out offset       | CH1 SIGNAL OUT      | RV18        | A4       |
|                  | Vertical position center    | CH3 POSITION CENTER | RV14        | A4       |
|                  |                             | CH4 POSITION CENTER | RV15        | A5       |
|                  | Vert final amp gain         | VERT GAIN           | RV3         | A4       |
|                  | CH3 gain                    | CH3 GAIN            | RV16        | A4       |
|                  | CH4 gain                    | CH4 GAIN            | RV17        | A4       |
|                  | CH1 attenuator              | CH1 1/1 ATT COMP    | RV1         | A1 (CH1) |
|                  |                             | CH1 1/10 ATT PHASE  | C5          | A1 (CH1) |
|                  |                             | CH1 1/10 ATT CAP    | C4          | A1 (CH1) |
|                  |                             | CH1 1/100 ATT PHASE | C8          | A1 (CH1) |
|                  |                             | CH1 1/100 ATT CAP   | C7          | A1 (CH1) |
|                  | CH2 attenuator              | CH2 1/1 ATT COMP    | RV1         | A1 (CH2) |
|                  |                             | CH2 1/10 ATT PHASE  | C5          | A1 (CH2) |
|                  |                             | CH2 1/10 ATT CAP    | C4          | A1 (CH2) |
|                  |                             | CH2 1/100 ATT PHASE | C8          | A1 (CH2) |
|                  |                             | CH2 1/100 ATT CAP   | C7          | A1 (CH2) |
|                  | CH3 attenuator              | CH3 1/10 ATT PHASE  | C5          | A3 (CH3) |
|                  |                             | CH3 1/10 ATT CAP    | C4          | A3 (CH3) |
|                  | CH4 attenuator              | CH4 1/10 ATT PHASE  | C35         | A3 (CH4) |
|                  |                             | CH4 1/10 ATT CAP    | C34         | A3 (CH4) |
|                  | High frequency compensation | HF COMPEN           | RV23        | A4       |
|                  |                             |                     | CV9         | A4       |
|                  |                             |                     | RV24        | A4       |
|                  |                             | HF COMPEN (CH2)     | RV9         | A4       |
|                  |                             |                     | CV6         | A4       |
|                  |                             |                     | RV4         | A4       |
|                  |                             |                     | CV3         | A4       |
|                  | High frequency compensation | HF COMPEN           | RV1         | A5       |
|                  |                             |                     | CV2         | A5       |
|                  |                             |                     | RV2         | A5       |
|                  |                             |                     | CV3         | A5       |
|                  |                             |                     | RV4         | A5       |
|                  |                             |                     | RV5         | A5       |
|                  |                             |                     | CV1         | A5       |

Table 4-11 Adjustment Table (1)

| Item               | Adjustment                  | Adjustment name  | Circuit No. | Board |
|--------------------|-----------------------------|------------------|-------------|-------|
| Vertical Circuit   | High frequency compensation | HF COMPEN (CH1)  | RV7         | A4    |
|                    |                             |                  | CV5         | A4    |
|                    |                             |                  | RV2         | A4    |
|                    |                             |                  | CV1         | A4    |
|                    |                             |                  | RV3         | A4    |
|                    |                             |                  | CV2         | A4    |
|                    |                             | HF COMPEN (CH2)  | RV5         | A4    |
|                    |                             |                  | CV4         | A4    |
|                    |                             | HF COMPEN (CH3)  | RV11        | A4    |
|                    |                             |                  | CV7         | A4    |
| Trigger Circuit    | Trigger level (AUTO)        | TRIG CENTER ⊕    | RV25        | A4    |
|                    |                             | TRIG CENTER ⊙    | RV26        | A4    |
|                    | Ttrigger DC offset          | CH1 TRIG OFFSET  | RV6         | A4    |
|                    |                             | CH2 TRIG OFFSET  | RV8         | A4    |
|                    |                             | CH3 TRIG OFFSET  | RV10        | A4    |
|                    |                             | CH4 TRIG OFFSET  | RV12        | A4    |
| Horizontal Circuit | Horizontal amp gain         | HORIZ GAIN ADJ   | RV7         | A5    |
|                    | Comparator start            | COMP START ADJ   | RV29        | A4    |
|                    | X-Y center                  | X POSITION       | RV30        | A4    |
| Horizontal Circuit | X-Y gain                    | X-Y GAIN         | RV31        | A4    |
|                    | Sweep length                | A SWEEP LENGTH   | RV27        | A4    |
|                    |                             | B SWEEP LENGTH   | RV28        | A4    |
|                    | Horizontal amp × 10mag gain | × 10MAG GAIN     | RV34        | A4    |
|                    | 5ns/DIV, 2ns/DIV sweep time | H-AMP HF COMPEN  | RV8         | A5    |
|                    |                             |                  | RV5         | A5    |
| DVM                | DVM compensation            | DVM COMPEN       | RV19        | A4    |
| STORAGE            | Storage horizontal positon  | SWEEP START      | RV5         | A18   |
|                    | Storage horizontal gain     | SWEEP GAIN       | RV4         | A18   |
|                    | Storage vertical gain       | D/A GAIN         | RV1         | A18   |
|                    | Storage vertical positoin   | D/A OFFSET       | RV2         | A18   |
|                    | storage HF compensation     | HF COMPEN (STR)  | RV3         | A18   |
|                    | CH1 A/D gain                | CH1 A/D GAIN     | RV1         | A16   |
|                    | CH1 A/D offset              | CH1 A/D OFFSET   | RV2         | A16   |
|                    | CH2 A/D gain                | CH2 A/D GAIN     | RV3         | A16   |
|                    | CH2 A/D offset              | CH2 A/D GAIN     | RV4         | A16   |
|                    | A/D gain balance            | CH1 A/D GAIN ADJ | RV1         | A15   |
|                    |                             | CH2 A/D GAIN ADJ | RV2         | A15   |
|                    | CH1 envelope gain           | CH1 BOTTOM GAIN  | RV6         | A15   |
|                    |                             | CH1 PEAK GAIN    | RV4         | A15   |
|                    | CH2 envelope gain           | CH2 BOTTOM GAIN  | RV5         | A15   |
|                    |                             | CH2 PEAK GAIN    | RV3         | A15   |

Table 4-12 Adjustment Table (2)





# **SECTION 5**

## **MAINTENANCE**

First Edition First Printing March 1988



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## 5. MAINTENANCE

### 5.1 Preventive Maintenance

#### 5.1.1 Description

Preventive maintenance consist of cleaning and visual inspection.

By performing such maintenance periodically, unforeseen breakdown can be minimized.

#### 5.1.2 Cleaning

Remove all dirt and dust from inside the unit. Either blow them away using an air compressor or suck them up with a vacuum cleaner. Especially those stuck on the high voltage portions. Also the heat sink should be kept clean.

#### CAUTION

This unit must not be cleaned with water or cleaning agent. Including case, panel, etc. it is recommended to use a cloth moistened with Diflon to wipe out a part dirt and dust.

Never use benzine, thinner, toluene, for this purpose.

#### 5.1.3 Visual inspection

After completion of the cleaning, visually inspect the unit. Pay attention to the connectors, sockets, inner connecting cables, loose screws, and soon.

#### 5.1.4 Lubrication to a fan motor

Since a maintenance-free type fan motor is used, no lubrication is needed.

#### 5.1.5 Semiconductor check

There is no need to check transistors and other semiconductors of this unit. Periodically as long as the unit operate properly.

## 5.2 Troubleshooting

### 5.2.1 Description

If the operation of this unit seems to be abnormal, have a performance check. If the performance check shows abnormal operation, examine which section of the unit (vertical system, horizontal system, or CRT and its related circuit) the malfunction belongs, and thoroughly understand the directions of signal conveying routes with the block diagram.

Also, look at the circuit diagram to find a defective circuit. Parts location on the board, etc. will be a great help at this time. After reaching a defective circuit and find out a defective part, refer to the parts list (electronic) for a capacity or a value. This unit utilizes the special parts to the circuit when it requires. When replacing, be sure to verify a capacity or a value of the defective part, and use the company's specified one or an equivalent one.

In addition, when repairing is performed, follow the calibrating items to adjust the defective portion or to make entire adjustments.

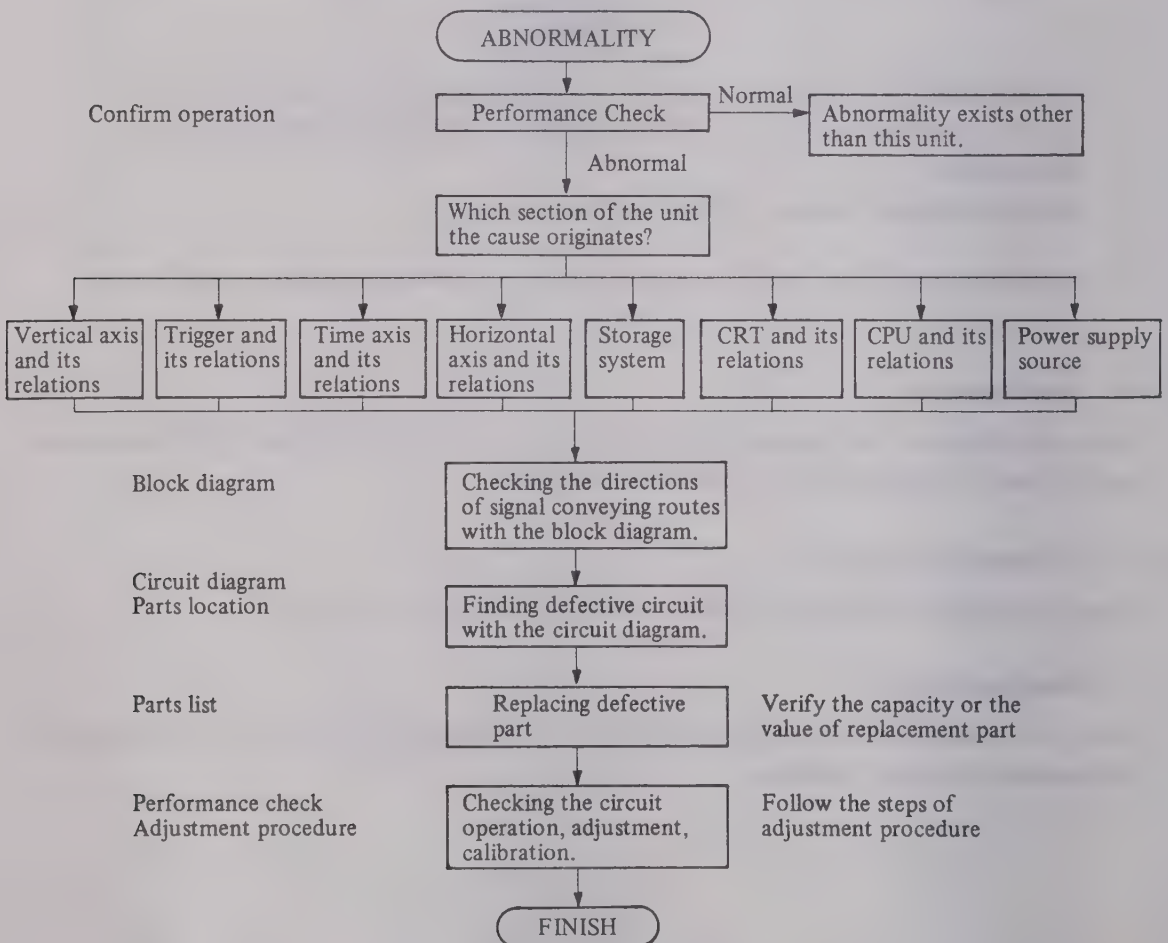
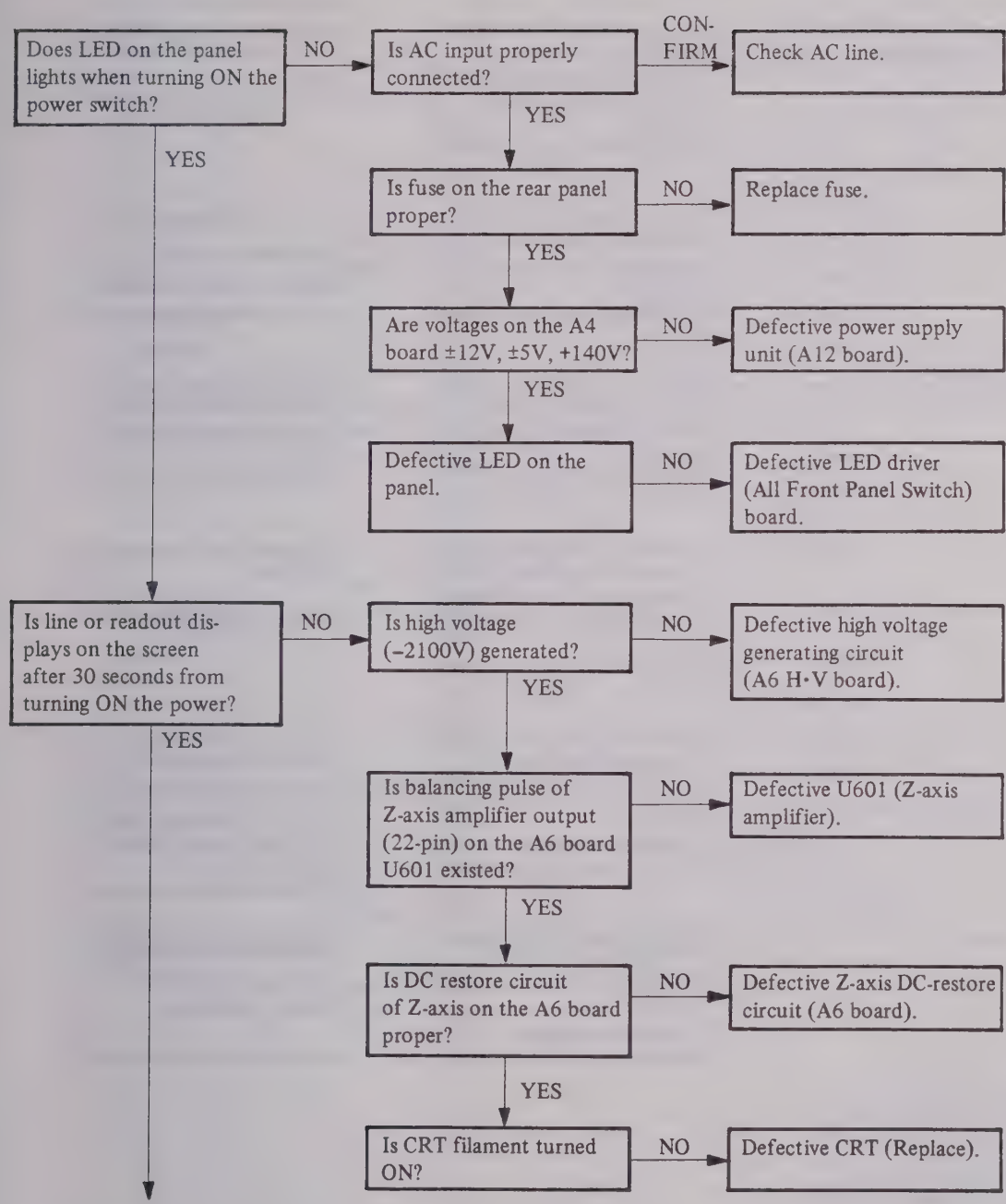


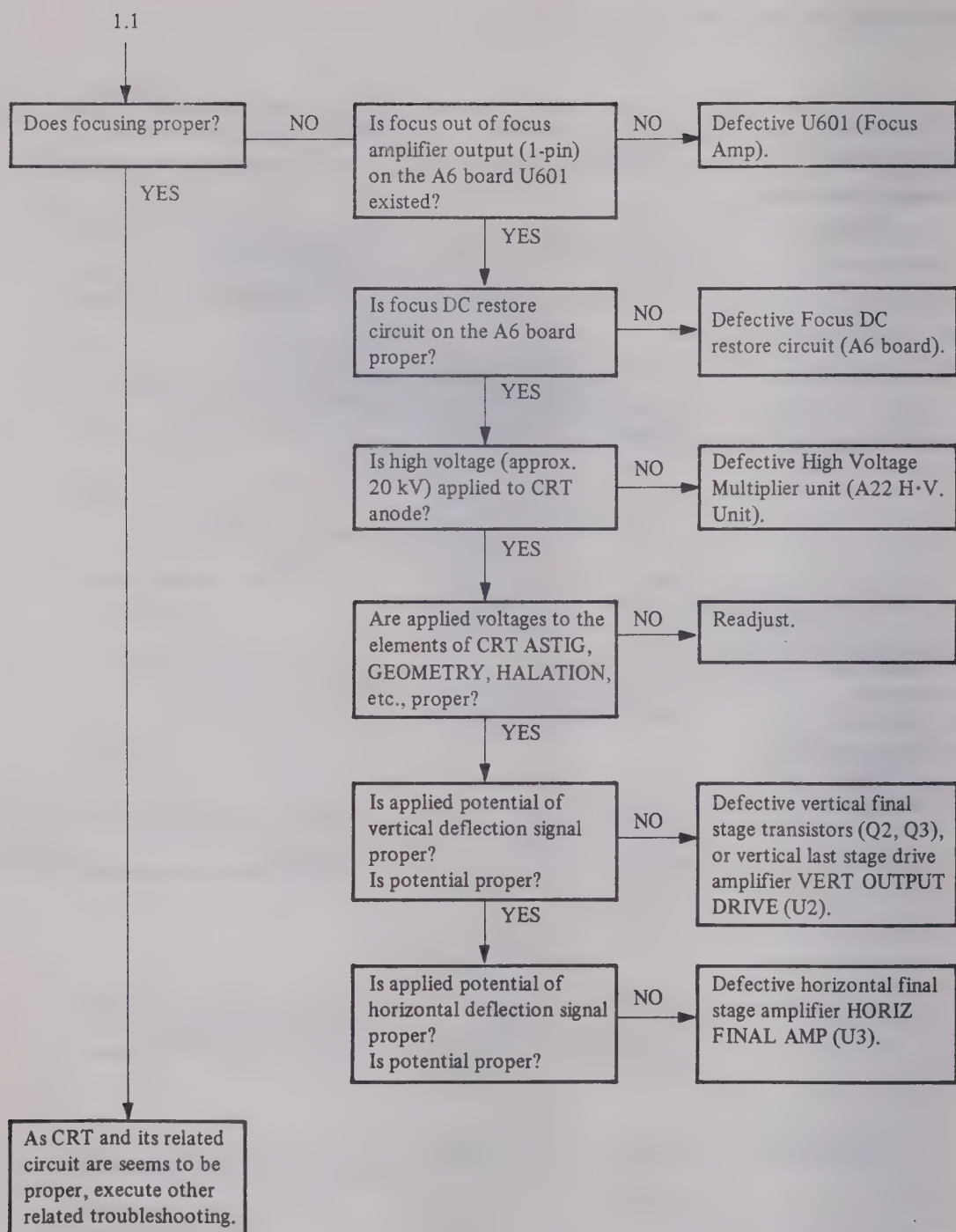
Figure 5-1 Flow Chart of Troubleshooting

5.2.2 Power supply, CRT and its related circuit



Continued to 1.1





### 5.2.3 Vertical system

Table 5-1 shows the vertical system troubleshooting chart.

| Defective Functions |                            | Symptom                                                                              | Defective Circuits                           | Replacement Parts |         |            |                                     |
|---------------------|----------------------------|--------------------------------------------------------------------------------------|----------------------------------------------|-------------------|---------|------------|-------------------------------------|
|                     |                            |                                                                                      |                                              | Board             | CKT No. | Code No.   | Name of Parts                       |
| ATTENUATOR          | CH1/CH2                    | Defective AC/DC/GND/50Ω or 1/1, 1/10, 1/100 ATT.                                     | 1st ATT Unit                                 | A1                |         | 36-00-1032 | H3 VERTICAL 1st ATT (CH1/CH2)       |
|                     |                            | Defective 1/2, 1/5 ATT.                                                              | RELAY                                        | A1                |         | 71-07-0370 | RELAY                               |
|                     | CH3/CH4                    | Defective AC/DC/GND or 1/1, 1/5 ATT.                                                 | 2nd ATT Unit                                 | A4                | U3/U4   | 36-00-1052 | H5 VERTICAL 2nd ATT                 |
|                     |                            |                                                                                      | ATT Unit                                     | A3                |         | 36-00-1042 | H4 VERTICAL 1st ATT (CH3/CH4)       |
| VARIABLE            | CH1                        | Defective VARIABLE DC BAL or VARIABLE not functions.                                 | CH1 1st AMP                                  | A4                | U11     | 36-00-1062 | H6 VERTICAL 1st AMPLIFIER           |
|                     | CH2                        | Defective VARIABLE DC BAL or VARIABLE not functions.                                 | CH2 1st AMP                                  | A4                | U12     | 36-00-1062 | H6 VERTICAL 1st AMPLIFIER           |
| POSITION control    | CH1                        | In despite of proper deflection factor, POSITION malfunctions.                       | CH1 2nd AMP                                  | A4                | U13     | 36-00-1072 | H7 VERTICAL 2nd AMPLIFIER           |
|                     | CH2                        | In despite of proper deflection factor, POSITION malfunctions.                       | CH2 2nd AMP                                  | A4                | U14     | 36-00-1072 | H7 VERTICAL 2nd AMPLIFIER           |
|                     | CH3                        | In despite of proper deflection factor, POSITION malfunctions.                       | CH3 2nd AMP                                  | A4                | U15     | 36-00-1074 | H7 VERTICAL 2nd AMPLIFIER (CH3/CH4) |
|                     | CH4                        | In despite of proper deflection factor, POSITION malfunctions.                       | CH4 2nd AMP                                  | A4                | U15     | 36-00-1082 | H7 VERTICAL 2nd AMPLIFIER (CH3/CH4) |
| DEFLECTION factor   | CH1 only                   | In despite of proper CH1 signal out, DEFLECTION factor is defective.                 | VERT MODE SWITCH circuit                     | A4                | U20     | 36-90-1082 | H8 VERT MODE SWITCH                 |
|                     |                            | Defective CH1 signal out, also POSITION malfunctions.                                | CH1 2nd AMP                                  | A4                | U13     | 36-00-1072 | H7 VERTICAL 2nd AMPLIFIER           |
|                     |                            | In despite of defective CH1 signal out, POSITION properly functions                  | CH1 1st AMP                                  | A4                | U11     | 36-00-1062 | H6 VERTICAL 1st AMPLIFIER           |
|                     | CH2 only                   | In despite of defective CH2 POSITION, CH2 VARIABLE, trigger is proper by CH2 signal. | VERT MODE SWITCH circuit                     | A4                | U20     | 36-00-1082 | H8 VERT MODE SWITCH                 |
|                     |                            | Defective CH2 POSITION, CH2 VARIABLE, also trigger is defective by CH2 signal.       | CH2 2nd AMP                                  | A4                | U14     | 36-00-1072 | H7 VERTICAL 2nd AMPLIFIER           |
|                     |                            | In despite of defective CH2 VARIABLE, CH2 POSITION is proper.                        | CH2 1st AMP                                  | A4                | U12     | 36-00-1062 | H6 VERTICAL 1st AMPLIFIER           |
|                     | CH3 only                   | CH3 POSITION is also defective.                                                      | VERT MODE SWITCH circuit                     | A4                | U20     | 36-00-1082 | H8 VERT MODE SWITCH                 |
|                     |                            | CH3 POSITION is proper.                                                              | CH3 2nd AMP                                  | A4                | U15     | 36-00-1074 | H7 VERTICAL 2nd AMPLIFIER (CH3/CH4) |
|                     | CH4 only                   | CH4 POSITION is also defective.                                                      | VERT MODE SWITCH circuit                     | A4                | U20     | 36-00-1082 | H8 VERT MODE SWITCH                 |
|                     |                            | CH4 POSITION is proper.                                                              | CH4 2nd AMP                                  | A4                | U15     | 36-00-1074 | H7 VERTICAL 2nd AMPLIFIER (CH3/CH4) |
|                     | CH1 thru CH4 all Defective | CRT graphic display is proper.                                                       | VERT MODE SWITCH circuit                     | A4                | U20     | 36-00-1082 | H8 VERT MODE SWITCH                 |
|                     |                            | CRT graphic display is also defective.                                               | DELAY LINE DRIVER or VERT OUT DRIVER circuit | A4                | U25     | 36-00-1092 | H9 DELAY LINE DRIVER                |
|                     |                            |                                                                                      |                                              | A5                | U2      | 36-00-1102 | H10 VERTICAL FINAL DRIVER           |

Table 5-1 Troubleshooting Chart for Vertical System



## 5.2.4 Trigger system

Table 5-2 shows the trigger system troubleshooting chart.

| Defective Functions   |                                  | Symptom                                                                                                                                                  | Defective Circuits                 | Replacement Parts |         |            |                              |
|-----------------------|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------|---------|------------|------------------------------|
|                       |                                  |                                                                                                                                                          |                                    | Board             | CKT No. | Code No.   | Name of Parts                |
| Does not<br>A TRIGGER | CH1 only                         | In case of signal level is lesser when compared with CH2 trigger by observing the scope at A4 board U275-pin (A trigger out).                            | CH1 2nd AMP                        | A4                | U13     | 36-00-1072 | H7 VERTICAL 2nd AMPLIFIER    |
|                       | CH2 only                         | In case of signal level is lesser when compared with CH1 trigger by observing the scope at A4 board U275-pin (A trigger out).                            | CH2 2nd AMP                        | A4                | U14     | 36-00-1072 | H7 VERTICAL 2nd AMPLIFIER    |
|                       | CH3 only                         | In case of signal level is lesser when compared with CH4 trigger by observing the scope at A4 board U275-pin (A trigger out).                            | CH3 2nd AMP                        | A4                | U15     | 36-00-1074 | H7 VERTICAL 2nd AMPLIFIER    |
|                       | CH4 only                         | In case of signal level is lesser when compared with CH3 trigger by observing the scope at A4 board U275-pin (A trigger out).                            | CH4 2nd AMP                        | A4                | U16     | 36-00-1074 | H7 VERTICAL 2nd AMPLIFIER    |
|                       | CH1 thru<br>CH4 all<br>defective | Trigger signal is existing at A4 board U48 52-pin (A trig in), and B trigger functions.                                                                  | SWEEP CONTROLLER                   | A4                | U48     | 36-00-1252 | H25 SWEEP CONTROLLER         |
|                       |                                  | Trigger signal is existing at A4 board U30 2-pin, but the same level trigger signal not exists at the same IC 21-pin (change trigger level for trial).   | A TRIGGER LEVEL COMPARATOR circuit | A4                | U30     | 36-00-1232 | H23 TRIGGER LEVEL COMPARATOR |
|                       |                                  | Trigger signal is existing at A4 board U28 2-pin, but the same level trigger signal not exists at the same IC 4-pin (switch trigger coupling for trial). | B TRIGGER COUPLING circuit         | A4                | U28     | 36-00-1220 | H22 TRIGGER COUPLING         |
|                       |                                  | No trigger signal at A4 board U27 5-pin, but B trigger functions.                                                                                        | A/B TRIGGER SOURCE SWITCH          | A4                | U27     | 36-00-1212 | H21 TRIGGER SOURCE SWITCH    |
| Does not B<br>TRIGGER | CH1 only                         | In case of signal level is lesser when compared with CH2 trigger by observing the scope at A4 board U27 22-pin (B trigger out).                          | CH1 2nd AMP                        | A4                | U13     | 36-00-1072 | H7 VERTICAL 2nd AMPLIFIER    |
|                       | CH2 only                         | In case of signal level is lesser when compared with CH1 trigger by observing the scope at A4 board U27 22-pin (B trigger out).                          | CH2 2nd AMP                        | A4                | U14     | 36-00-1072 | H7 VERTICAL 2nd AMPLIFIER    |
|                       | CH3 only                         | In case of signal level is lesser when compared with CH4 trigger by observing the scope at A4 board U27 22-pin (B trigger out).                          | CH3 2nd AMP                        | A4                | U15     | 36-00-1074 | H7 VERTICAL 2nd AMPLIFIER    |
|                       | CH4 only                         | In case of signal level is lesser when compared with CH3 trigger by observing the scope at A4 board U27 22-pin (B trigger out).                          | CH4 2nd AMP                        | A4                | U16     | 36-00-1074 | H7 VERTICAL 2nd AMPLIFIER    |
|                       | CH1 thro<br>CH4 all<br>defective | Trigger signal is existing at A4 board U48 50-pin (B trig in), and A trigger functions.                                                                  | SWEEP CONTROLLER                   | A4                | U48     | 36-00-1252 | H25 SWEEP CONTROLLER         |
|                       |                                  | Trigger signal is existing at A4 board U31 2-pin, but the same level trigger signal not exists at the same IC 21-pin (change trigger level for trial).   | B TRIGGER LEVEL COMPARATOR circuit | A4                | U31     | 36-00-1232 | TRIGGER LEVEL COMPARATOR     |
|                       |                                  | Trigger signal is existing at A4 board U29 2-pin, but the same level trigger signal not exists at the same IC 4-pin (switch trigger coupling for trial). | B TRIGGER COUPLING circuit         | A4                | U29     | 36-00-1220 | TRIGGER COUPLING             |
|                       |                                  | No trigger signal at A4 board U27 22-pin, but A trigger functions.                                                                                       | TRIGGER SOURCE SWITCH              | A4                | U27     | 36-00-1212 | TRIGGER SOURCE SWITCH        |
| Do not A/B TRIGGER    |                                  | In case of no trigger signal are existing both at A4 board U27 5-pin (A trigger out) and 22-pin (B trigger out).                                         | TRIGGER SOURCE SWITCH              | A4                | U27     | 36-00-1212 | TRIGGER SOURCE SWITCH        |
|                       |                                  | In case of trigger signals are existing both at A4 board U48 52-pin (A trig in) and 50-pin (B trig in).                                                  | SWEEP CONTROLLER                   | A4                | U48     | 36-00-1252 | H25 SWEEP CONTROLLER         |

Table 5-2 Troubleshooting Chart for Trigger System





5.2.5 Time axis system

Table 5-3 shows the time axis system troubleshooting chart.

| Defective Function        |                    | Symptom                                                                                                                                                       | Defective Circuits                   | Replacement Parts |         |            |                               |
|---------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-------------------|---------|------------|-------------------------------|
|                           |                    |                                                                                                                                                               |                                      | Board             | CKT No. | Code No.   | Name of Parts                 |
| A SWEEP<br>NO SWEEP       | All ranges         | Sweep waveform is existing at A4 board U48 18-pin or U43 3-pin. Character display on the CRT is proper.                                                       | SWEEP & COMPARATOR SWITCH            | A4                | U52     | 36-00-1290 | H29 SWEEP & COMPARATOR SWITCH |
|                           |                    | Trigger signal is existing at A4 board U48 52-pin (A trig in) and X-Y function. No sweep waveform exists at A4 board U48 18-pin or U43 3-pin.                 | SWEEP CONTROLLER, or SWEEP GENERATOR | A4                | U48     | 36-00-1252 | H25 SWEEP CONTROLLER          |
|                           |                    |                                                                                                                                                               |                                      | A4                | U43     | 36-00-1270 | H27 SWEEP GENERATOR           |
|                           | Some of the ranges | Phenomenon on the CRT and the generated sweep waveform at A4 board U48 18-pin or U43 3-pin coincide.                                                          | SWEEP GENERATOR                      | A4                | U43     | 36-00-1270 | H27 SWEEP GENERATOR           |
| A SWEEP TIME out of spec. |                    | Character display on the CRT is proper.                                                                                                                       | SWEEP GENERATOR                      | A4                | U43     | 36-00-1270 | H27 SWEEP GENERATOR           |
| B SWEEP<br>NO SWEEP       | All ranges         | Sweep waveform is existing at A4 board U48 6-pin or U44 3-pin. Character display on the CRT is proper.                                                        | SWEEP & COMPARATOR SWITCH            | A4                | U52     | 36-00-1290 | H29 SWEEP & COMPARATOR SWITCH |
|                           |                    | A sweep is normal. No sweep waveform exists at A4 board U52 20-pin.                                                                                           | SWEEP & COMPARATOR SWITCH            | A4                | U52     | 36-00-1290 | H29 SWEEP & COMPARATOR SWITCH |
|                           |                    | A sweep is normal. Sweep waveform is existing at A4 board U52 20-pin, but no signal exists at the same IC 11-pin or 12-pin.                                   | DELAY TIME COMPARATOR                | A4                | U56     | 36-00-1281 | H28 DELAY TIME COMPARATOR     |
|                           |                    | A sweep is normal. Signal is delivered to A4 board U48 28, 29-pin (DLY TRIG IN) from Comparator. No sweep waveform exists at A4 board U48 6-pin or U44 3-pin. | SWEEP CONTROLLER or SWEEP GENERATOR  | A4                | U48     | 36-00-1252 | H25 SWEEP CONTROLLER          |
|                           | Some of the ranges | Phenomenon on the CRT and the generated sweep waveform at A4 board U48 6-pin or U44 3-pin coincide.                                                           | SWEEP GENERATOR                      | A4                | U44     | 36-00-1270 | H27 SWEEP GENERATOR           |
| B SWEEP TIME out of spec. |                    | Character display on the CRT is proper.                                                                                                                       | SWEEP GENERATOR                      | A4                | U44     | 36-00-1270 | H27 SWEEP GENERATOR           |

Table 5-3 Troubleshooting Chart for Time Axis System

5.2.6 Horizontal axis system

Table 5-4 shows the horizontal axis system troubleshooting

| Defective Function           |  | Symptom                                                                                    | Defective Circuits                | Replacement Parts |         |            |                                   |
|------------------------------|--|--------------------------------------------------------------------------------------------|-----------------------------------|-------------------|---------|------------|-----------------------------------|
|                              |  |                                                                                            |                                   | Board             | CKT No. | Code No.   | Name of Parts                     |
| SWEEP NO SWEEP               |  | X-Y function, character display on the CRT, and horizontal position are normal.            | U52 SWEEP COMPARATOR SWITCH       | A4                | U52     | 36-00-1290 | H29 SWEEP & COMPARATOR SWITCH     |
|                              |  | Horizontal position is abnormal, X-Y function and character display on the CRT are normal. | U55 HORIZONTAL SWITCHING & DRIVER | A4                | U55     | 36-00-1302 | H30 HORIZONTAL SWITCHING & DRIVER |
|                              |  | X-Y function, character display on the CRT, and horizontal position are abnormal.          | HORIZONTAL FINAL AMP              | A5                | U3      | 36-00-1312 | H31 HORIZONTAL FINAL AMPLIFIER    |
| Abnormal HORIZONTAL POSITION |  | Sweep, X-Y function, and character display on the CRT are normal.                          | ANALOG MPX                        | A4                | U66     | 36-00-1140 | H14 ANALOG MULTIPLEXER            |
| Abnormal x10 MAG             |  | In despite of A4 board U55 16-pin in "L", x10 MAG is abnormal.                             | U55 HORIZONTAL SWITCHING & DRIVER | A4                | U55     | 36-00-1302 | H30 HORIZONTAL SWITCHING & DRIVER |

Table 5-4 Troubleshooting Chart for Horizontal Axis System



### 5.2.7 Storage system

Table 5-5 shows the storage system troubleshooting chart.

Real time operation is in normal as a general rule.

| Defective Function                   |                                                                    |                             | Symptom                                                                                                                                                                          | Defective Circuits                                                                                                                  | Replacement Part                |         |            |                                |                               |
|--------------------------------------|--------------------------------------------------------------------|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|---------|------------|--------------------------------|-------------------------------|
|                                      |                                                                    |                             |                                                                                                                                                                                  |                                                                                                                                     | Board                           | CKT No. | Code No.   | Name of Parts                  |                               |
| STOR-<br>AGE<br>no-<br>storage       | Sweep<br>functions<br>(previous<br>stage to<br>A/D con-<br>verter) | CH1 only                    | No input signal at A4 board U26 6/5-pin and 10/9-pin. Input signal exists when the unit's vert mode is in CH2.                                                                   | VERT MODE SWITCH, or STORAGE SIGNAL BUFFER.                                                                                         | A4                              | U20     | 36-00-1082 | H8 VERT MODE SWITCH            |                               |
|                                      |                                                                    |                             |                                                                                                                                                                                  |                                                                                                                                     | A4                              | U26     | 36-00-1110 | H11 STORAGE SIGNAL BUFFER      |                               |
|                                      |                                                                    | CH2 only                    | No input signal at A4 board U26 6/5-pin and 10/9-pin. Input signal exists when the unit's vert mode is in CH1.                                                                   | VERT MODE SWITCH, or STORAGE SIGNAL BUFFER.                                                                                         | A4                              | U20     | 36-00-1082 | H8 VERT MODE SWITCH            |                               |
|                                      |                                                                    |                             |                                                                                                                                                                                  |                                                                                                                                     | A4                              | U26     | 36-00-1110 | H11 STORAGE SIGNAL BUFFER      |                               |
|                                      |                                                                    | All CH2                     | Input signal is existing at A4 board U26 6/5-pin and 10/9-pin, but no input signal exists at A15 board H12 17/16-pin and 24/23-pin.                                              | STORAGE SIGNAL DRIVER.                                                                                                              | A15                             | U5      | 36-00-1120 | H12 STORAGE SIGNAL DRIVER      |                               |
|                                      |                                                                    |                             | Input signal is existing at A15 board H12 17/16-pin and 24/23-pin, but no input signal exists at A16 board U12A 23-pin.                                                          | A15 CHANNEL DIVIDER.                                                                                                                | A15                             | U6      | 36-00-1130 | H13 STORAGE CHANNEL DIVIDER    |                               |
|                                      |                                                                    |                             | Input signal is existing at A16 board U12A 23-pin, but no signal exists at A16 board U12A 3-pin (SAMPLING OUT). (Compare with U12C 3-pin.)                                       | A16 SAMPLE AND HOLD.                                                                                                                | A16                             | U12A    | 36-00-1180 | H18 SAMPLE and HOLD            |                               |
|                                      |                                                                    |                             | Input signal is existing at A16 board U12C 23-pin, but no signal exists at A16 board U12C 3-pin (SAMPLING OUT). (Compare with U12A 3-pin.)                                       | A16 SAMPLE AND HOLD.                                                                                                                | A16                             | U12C    | 36-00-1180 | H18 SAMPLE and HOLD            |                               |
|                                      |                                                                    |                             | “Sample and hold” input signal is existing at A16 board U11A 21-pin, but storage not functions.                                                                                  | A16 A/D CONVERTER.                                                                                                                  | A16                             | U11A    | 34-21-0000 | A/D CONVERTER                  |                               |
|                                      |                                                                    |                             | “Sample and hold” input signal is existing at A16 board U11C 21-pin, but storage not functions.                                                                                  | A16 A/D CONVERTER.                                                                                                                  | A16                             | U11C    | 34-21-0000 | A/D CONVERTER                  |                               |
|                                      | (Sub-<br>sequent<br>stage to<br>D/A con-<br>verter)                | All CHs                     | Character display is normal on the CRT. Reemerged input waveform is observed at A18 board U1B 10-pin.                                                                            | A4 U20 VERT MODE SWITCH.                                                                                                            | A4                              | U20     | 36-00-1082 | H8 VERT MODE SWITCH            |                               |
|                                      |                                                                    |                             | Character display is normal on the CRT. D/A converted output signal is existing at A18 board U1B 5-pin (D/A SIGNAL IN), but no signal exists at the same IC 10-pin (OUT).        | A18 U1B INTERPOLATOR.                                                                                                               | A18                             | U1B     | 36-00-1200 | H20 INTERPOLATOR               |                               |
|                                      |                                                                    | Sweep<br>not func-<br>tions | All CHs                                                                                                                                                                          | Character display is normal on the CRT. Sweep signal (STORAGE) is observed at A18 board U1C 10-pin.                                 | A4 U52 SWEEP COMPARATOR SWITCH. | A4      | U52        | 36-00-1290                     | H29 SWEEP & COMPARATOR SWITCH |
|                                      |                                                                    |                             |                                                                                                                                                                                  | Character display is normal on the CRT. Sweep signal (STORAGE) is observed at A18 board U1C 4-pin, but not at A18 board U1C 10-pin. | A18 U1C STORAGE DEGLITCHER.     | A18     | U1C        | 36-00-1320                     | H32 STORAGE DEGLITCHER        |
|                                      |                                                                    |                             |                                                                                                                                                                                  | Character display is normal on the CRT. No sweep signal is observed at A18 board U2C 18-pin.                                        | A18 U2C D/A CONVERTER (12-Bit). | A18     | U2C        | 36-20-0100                     | D/A CONVERTER 12 Bit          |
| ENVELOPE does<br>not function        |                                                                    | CH1/CH3<br>only             | PEAK or BOTTOM LEVEL moves out of the CRT screen when shift to EN-<br>VELOPE MODE.                                                                                               | A15 U8 ENVELOPE PEAK HOLD.                                                                                                          | A15                             | U8      | 36-00-1160 | H16 STORAGE ENVELOPE PEAK HOLD |                               |
|                                      |                                                                    | CH2/CH4<br>only             | PEAK or BOTTOM LEVEL moves out of the CRT screen when shift to EN<br>VELOPE MODE.                                                                                                | A15 U7 ENVELOPE PEAK HOLD.                                                                                                          | A15                             | U7      | 36-00-1160 | H16 STORAGE ENVELOPE PEAK HOLD |                               |
| Abnormal REPEAT function             |                                                                    |                             | Storage function (sweep time 50ms ~ 0.5 μs DIV) is normal in other than REPEAT MODE, but no waveform can be observed in REPEAT MODE.                                             | A17 U3B JITTER INTERVAL METER.                                                                                                      | A17                             | U3B     | 36-00-1330 | H33 JITTER INTERVAL METER      |                               |
| Abnormal dot joint                   |                                                                    |                             | Connecting function for each dot linking on the CRT screen waveform is defective that the CRT screen shows a staircase-like waveform. Or no waveform is displayed. (OVER SCALE.) | A18 U1B INTERPOLATOR.                                                                                                               | A18                             | U1B     | 36-00-1200 | H20 INTERPOLATOR               |                               |
| Noise on the horizontal<br>direction |                                                                    |                             | Apply an approx. 6 DIV 1 kHz sine wave, and when displaying 1 cycle on the CRT screen, a horizontal noise is observed.                                                           | A18 U1C STORAGE SWEEP<br>DEGLITCHER.                                                                                                | A18                             | U1C     | 36-00-1320 | H32 STORAGE SWEEP DEGLITCHER   |                               |

Table 5-5 Troubleshooting Chart for Storage System





5.2.8 List of board with the parts

Table 5-6 and 5-7 show the list of board with the parts employed in this unit.

1) COM7101A

| Assembly No. | KIKUSUI Parts No. | Name of Board                                     |
|--------------|-------------------|---------------------------------------------------|
| A1           | 36-00-1030        | H3 CH1, CH2 1st ATTENUATOR                        |
| A3           | 36-00-1040        | H4 CH3, CH4 1st ATTENUATOR                        |
| A4           | 97-11-0230        | A4 COM7101A MAIN BOARD FOR STORAGE                |
| A5           | 97-11-0032        | A5 COM71xxA VERTICAL & HORIZONTAL FINAL AMPLIFIER |
| A6           | 97-11-0040        | A6 COM71xxA HIGH VOLTAGE & Z-AXIS AMPLIFIER *1    |
| A7           | 97-11-0050        | A7 COM7xxxA CRT CONTROL                           |
| A8           | 97-11-0060        | A8 COM7xxxA MAIN CPU BOARD *2                     |
| A10          | 97-11-0070        | A10 COM7xxxA FRONT PANEL CONTROL                  |
| A11          | 97-11-0261        | A11 COM7101A FRONT PANEL SWITCH                   |
| A12          | 97-11-0280        | A12 COM7101A STORAGE POWER SUPPLY                 |
| A13          | 97-11-0250        | A13 COM7101A MOTHER BOARD STORAGE                 |
| A14          | 97-11-0121        | A14 COM7101A SUB CPU BANK VERSION                 |
| A15          | 97-11-0170        | A15 COM7101A ANALOG PROCESSING                    |
| A16          | 97-11-0150        | A16 COM7101A A/D MEMORY                           |
| A17          | 97-11-0140        | A17 COM7101A ACQUISITION CONTROL                  |
| A18          | 97-11-0130        | A18 COM7101A STORAGE DISPLAY                      |
| A22          | 97-11-0200        | A22 COM71xxA H.V. UNIT *1                         |

Note: \*1. A22 (H.V. UNIT) is not included in A6 (HIGH VOLTAGE & Z-AXIS AMPLIFIER).  
\*2. Because of PROGRAM ROM is built-in, specify the name of model when placing an order.

Table 5-6 List of Board with the Parts for COM7101A

2) COM7100A

| Assembly No. | KIKUSUI Parts No. | Name of Board                                     |
|--------------|-------------------|---------------------------------------------------|
| A1           | 36-00-1030        | H3 CH1, CH2 1st ATTENUATOR                        |
| A3           | 36-00-1040        | H4 CH3, CH4 1st ATTENUATOR                        |
| A4           | 97-11-0021        | A4 COM7100A MAIN BOARD                            |
| A5           | 97-11-0030        | A5 COM71xxA VERTICAL & HORIZONTAL FINAL AMPLIFIER |
| A6           | 97-11-0040        | A6 COM71xxA HIGH VOLTAGE & Z-AXIS AMPLIFIER *1    |
| A7           | 97-11-0050        | A7 COM7xxxA CRT CONTROL                           |
| A8           | 97-11-0060        | A8 COM7xxxA MAIN CPU BOARD *2                     |
| A10          | 97-11-0070        | A10 COM7xxxA FRONT PANEL CONTROL                  |
| A11          | 97-11-0081        | A11 COM7100A FRONT PANEL SWITCH                   |
| A12          | 97-11-0090        | A12 COM7100A POWER SUPPLY                         |
| A13          | 97-11-0100        | A13 COM7100A MOTHER BOARD                         |
| A22          | 97-11-0200        | A22 COM71xxA H.V. UNIT *1                         |

Note: \*1. A22 (H.V. UNIT) is not included in A6 (HIGH VOLTAGE & Z-AXIS AMPLIFIER).  
\*2. Because of PROGRAM ROM is built-in, specify the name of model when placing an order.

Table 5-7 List of Board with the Parts for COM7100A

### 5.2.9 Table of HIC functions

Functions of HIC utilized in this unit are as follows:

HIC for other than board assembly

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION                   | DESCRIPTIONS                                                              |
|---------|----------|---------------------|----------------------------|---------------------------------------------------------------------------|
|         | H3       | 36-00-1030          | VERTICAL 1st ATT (CH1)     | Coupling of CH1 signal (AC, DC, GND), and attenuation (1/1, 1/10, 1/100). |
|         | H3       | 36-00-1030          | VERTICAL 1st ATT (CH2)     | Coupling of CH2 signal (AC, DC, GND), and attenuation (1/1, 1/10, 1/100). |
|         | H4       | 36-00-1040          | VERTICAL 1st ATT (CH3/CH4) | Coupling of CH3 and CH4 (AC, DC, GND), and attenuation (1/1, 1/5).        |

HIC for A4 board assembly

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION                         | DESCRIPTIONS                                                                                                                                                          |
|---------|----------|---------------------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U3      | H5       | 36-00-1050          | VERTICAL 2nd ATT                 | CH1 signal (1/1, 1/2, 1/5).                                                                                                                                           |
| U4      | H5       | 36-00-1050          | VERTICAL 2nd ATT                 | CH2 signal (1/1, 1/2, 1/5).                                                                                                                                           |
| U11     | H6       | 36-00-1060          | VERTICAL 1st AMPLIFIER           | CH1 AMPLITUDE AND VARIABLE GAIN CONTROL.                                                                                                                              |
| U12     | H6       | 36-00-1060          | VERTICAL 1st AMPLIFIER           | CH2 AMPLITUDE AND VARIABLE GAIN CONTROL.                                                                                                                              |
| U13     | H7       | 36-00-1070          | VERTICAL 2nd AMPLIFIER           | CH1 AMPLITUDE AND POSITION CONTROL.                                                                                                                                   |
| U14     | H7       | 36-00-1070          | VERTICAL 2nd AMPLIFIER           | CH2 AMPLITUDE AND POSITION CONTROL.                                                                                                                                   |
| U15     | H7       | 36-00-1073          | VERTICAL 2nd AMPLIFIER (CH3/CH4) | CH3 AMPLITUDE AND POSITION CONTROL.                                                                                                                                   |
| U16     | H7       | 36-00-1073          | VERTICAL 2nd AMPLIFIER (CH3/CH4) | CH4 AMPLITUDE AND POSITION CONTROL.                                                                                                                                   |
| U17     | H14      | 36-00-1140          | ANALOG MULTIPLEXER               | Hold data (CH1, GAIN, CH1 POSITION, CH1 POSITION CENTER, CH1 VARIABLE, CH1 INPUT OFFSET, CH1 STEP BALANCE, DVM AUTO ZERO, DVM RMS OFFSET).                            |
| U18     | H14      | 36-00-1140          | ANALOG MULTIPLEXER               | Hold data (CH2 GAIN, CH2 POSITION, CH2 POSITION CENTER, CH2 VARIABLE, CH2 INPUT OFFSET, CH2 STEP BALANCE, CH3 POSITION, CH4 POSITION).                                |
| U19     | H19      | 36-00-1190          | CH1 SIGNAL OUTPUT AMPLIFIER      | CH1 SIGNAL OUTPUT.                                                                                                                                                    |
| U20     | H8       | 36-00-1080          | VERTICAL MODE SWITCH             | Switching of each vertical axis signal (CH1, CH2, CH3, CH4), and output (REAL SIGNAL, FOR X-Y SIGNAL (X AXIS), CHA & CHB SIGNAL (FOR STORAGE).                        |
| U21     | H42      | 36-00-1420          | DVM TRUE RMS CONVERTER           | True RMS conversion of vertical axis CH1 2nd ATT OUT, and output of each DVM function mode (DC, RMS, P-P, V-MONI).                                                    |
| U22     | H43      | 36-00-1430          | DVM PEAK DETECTOR                | Peak detector of H42 (DVM true RMS converter) To P-P signal, and re-outputs to H42 FROM P-P input.                                                                    |
| U25     | H9       | 36-00-1090          | DELAY LINE DRIVER                | Delay line driver (VERTICAL REALTIME SIGNAL & VERTICAL CHARACTER SIGNAL).                                                                                             |
| U26     | H11      | 36-00-1110          | STORAGE SIGNAL BUFFER            | Buffering H8 (vertical mode switch) CHA and CHB signals, and outputs to A15 (Analog processing board). Band width limiter for storage is built-in.                    |
| U27     | H21      | 36-00-1210          | TRIGGER SOURCE SWITCH            | Switching of each vertical axis trigger signal (CH1, CH2, CH3, CH4), and A/B 2-SYSTEM trigger output of line trigger signal.                                          |
| U28     | H22      | 36-00-1220          | TRIGGER COUPLING SWITCH          | A trigger signal coupling (AC, LF REJ, HF REJ, DC, TV-V, TV-H).                                                                                                       |
| U29     | H22      | 36-00-1220          | TRIGGER COUPLING SWITCH          | B trigger signal coupling (AC, LF REJ, HF REJ, DC, TV-V, TV-H).                                                                                                       |
| U30     | H23      | 36-00-1230          | TRIGGER LEVEL COMPARATOR         | A trigger comparator and slope control.                                                                                                                               |
| U31     | H23      | 36-00-1230          | TRIGGER LEVEL COMPARATOR         | B trigger comparator and slope control.                                                                                                                               |
| U32     | H24      | 36-00-1240          | TV SYNCHRONIZE SEPARATOR         | TV sync. separator circuit to detect TV synchro signal from A trigger signal.                                                                                         |
| U43     | H27      | 36-00-1270          | SWEEP GENERATOR                  | A sweep generator.                                                                                                                                                    |
| U44     | H27      | 36-00-1270          | SWEEP GENERATOR                  | B sweep generator.                                                                                                                                                    |
| U48     | H25      | 36-00-1250          | SWEEP CONTROLLER                 | Overall controlling of A/B sweep circuit.                                                                                                                             |
| U52     | H29      | 36-00-1290          | SWEEP & COMPARATOR SWITCH        | Switching circuit of A/B sweep signals.                                                                                                                               |
| U55     | H30      | 36-00-1302          | HORIZONTAL SWITCHING & DRIVER    | Selecting and amplifying of horizontal axis signal (A/B sweep signals, X-Y signals, horizontal character signal), horizontal position, beam find, x10 magnifier, etc. |
| U56     | H28      | 36-00-1280          | DELAY TIME COMPARATOR            | Delay sweep comparator circuit, making B sweep gate signal from A sweep signal.                                                                                       |
| U57     | H34      | 36-00-1340          | Z AXIS SWITCH & Z AXIS DRIVER    | Switching circuit of each Z axis signal (A/B sweep gate, character intergate, storage intergate, ext Z in, etc.), and output buffer circuit.                          |
| U58     | H26      | 36-00-1260          | PRESCALER                        | For frequency counter (switches to 1/1, 1/10, 1/100 according to the input frequency).                                                                                |





## HIC for A4 board assembly (continued)

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION            | DESCRIPTION                                                                                                              |
|---------|----------|---------------------|---------------------|--------------------------------------------------------------------------------------------------------------------------|
| U59     | H41      | 36-00-1410          | SEQUENCE CONTROLLER | Vertical mode and display mode on the panel.                                                                             |
| U65     | H14      | 36-00-1140          | ANALOG MULTIPLEXER  | Hold data ((A/B TRIG LEVEL, SWEEP HOLDOFF, A/B SWEEP VARIABLE, A SWEEP POSITION, B SWEEP POSITION, COMPARATOR LEVEL)     |
| U66     | H14      | 36-00-1140          | ANALOG MULTIPLEXER  | Hold data (CURSOR 1/2 LEVEL, B SWEEP INTEN, CHARACTER INTEN, HORIZONTAL POSITION, SCALE ILLUMINATION, TRACE SEPARATION). |

## HIC for A5 board assembly

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION                   | DESCRIPTION                                                   |
|---------|----------|---------------------|----------------------------|---------------------------------------------------------------|
| U2      | H10      | 36-00-1100          | VERTICAL FINAL DRIVER      | Amplifying vertical signal, and drive final stage transistor. |
| U3      | H31      | 36-00-1310          | HORIZONTAL FINAL AMPLIFIER | Amplifying horizontal signal, and final stage.                |

## HIC for A6 board assembly

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION                   | DESCRIPTION                                          |
|---------|----------|---------------------|----------------------------|------------------------------------------------------|
| U601    | H31      | 36-00-1310          | HORIZONTAL FINAL AMPLIFIER | Amplifying Z axis signal, and final stage of Z axis. |

## HIC for A15 board assembly

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION                   | DESCRIPTION                                                                                                                                                                          |
|---------|----------|---------------------|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U5      | H12      | 36-00-1120          | STORAGE SIGNAL DRIVER      | Impedance conversion circuit for H13 & H16.                                                                                                                                          |
| U6      | H13      | 36-00-1130          | STORAGE CHANNEL DRIVER     | Switching circuit obtains 2 pairs of balanced in and output and enable to set output according to dual mode/single mode, ALT chop, and sampling speed (Sweep speed of storage mode). |
| U7      | H16      | 36-00-1160          | STORAGE ENVELOPE PEAK HOLD | Peak and bottom hold circuit for CHA (CH1 or CH3) (obtains 2 sets of peak hold circuit, performs reversing and non-reversing of differential).                                       |
| U8      | H16      | 36-00-1160          | STORAGE ENVELOPE PEAK HOLD | Peak and bottom hold circuit for CHB (CH2 or CH4) (obtains 2 sets of peak hold circuit, performs reversing and non-reversing of differential).                                       |

## HIC for A16 board assembly

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION      | DESCRIPTION                                                                            |
|---------|----------|---------------------|---------------|----------------------------------------------------------------------------------------|
| U12A    | H18      | 36-00-1180          | SAMPLE & HOLD | Sample and hold circuit for CHA (CH1 or CH3) with reference voltage for A/D converter. |
| U12C    | H18      | 36-00-1180          | SAMPLE & HOLD | Sample and hold circuit for CHB (CH2 or CH4) with reference voltage for A/D converter. |

## HIC for A17 board assembly

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION               | DESCRIPTION                                                                                                                      |
|---------|----------|---------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| U1B     | H15      | 36-00-1150          | ANALOG MULTIPLEXER DIP | Hold data (JITCAL, HOLDOFF RANDOMIZED, CHA BAL, CHB BAL, CHA PEAK OFFSET, CHA BOTTOM OFFSET, CHB PEAK OFFSET, CHB BOTTOM OFFSET) |
| U14C    | H36      | 36-00-1360          | CLOCK GENERATOR        | Obtains 50MHz and 40MHz crystal oscillator and OR circuit, delivers one of which signal according to sampling speed.             |
| U3B     | H33      | 36-00-1330          | JITTER INTERVAL METER  | Expanding circuit of time from trigger signal to random sample signal by double integrally.                                      |

## HIC for A18 board assembly

| CKT NO. | HIC NAME | KIKUSUI'S PARTS NO. | FUNCTION                 | DESCRIPTION                                                                                                   |
|---------|----------|---------------------|--------------------------|---------------------------------------------------------------------------------------------------------------|
| U1B     | H20      | 36-00-1200          | INTERPOLATOR             | Dot joinner to connect staircase-like vertical axis converter output signal in straight line at storage mode. |
| U1C     | H32      | 36-00-1320          | STORAGE SWEEP DEGLITCHER | Removing circuit to remove glitch noise with horizontal axis converter output integrally at storage mode.     |



# **SECTION 6**

## **CIRCUIT DIAGRAM**

First Edition First Printing March 1988





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## 6. CIRCUIT DIAGRAM

### 6.1 Description

This chapter shows the COM 7101A circuit diagram. The circuit diagram of COM 7100A is composed basically the same as COM 7101A except the storage and GP-IB sections are excluded.

#### 6.1.1 List of circuit diagrams

Table 6-1 shows the list of circuit diagrams classified by assembly.

| MODEL                  | ASSEMBLY      | NAME OF CIRCUIT DIAGRAM                                          | DRAWING No. |
|------------------------|---------------|------------------------------------------------------------------|-------------|
| COM 7101A<br>COM 7100A | A1            | CH1, CH2 ATTENUATOR                                              | 0           |
|                        | A3            | CH3, CH4 ATTENUATOR                                              | 0           |
|                        | A4            | VERTICAL PREAMPLIFIER                                            | 1           |
|                        | A4            | TRIG & A/B SWEEP GENERATOR                                       | 2           |
|                        | A4            | HORIZONTAL SWITCH & Z AXIS CONTROL                               | 3           |
|                        | A5            | VERTICAL OUTPUT AMPLIFIER &<br>HORIZONTAL OUTPUT AMPLIFIER       | 4           |
|                        | A6, A22       | Z AXIS AMPLIFIER & HIGH VOLTAGE UNIT                             | 5           |
|                        | A7            | CRT CONTROL                                                      | 6           |
|                        | A8            | MAIN CPU (1/2)                                                   | 7           |
|                        | A8            | MAIN CPU (2/2)                                                   | 8           |
|                        | A10           | PANEL CONTROLS (1/2)                                             | 9           |
|                        | A11           | PANEL CONTROLS (2/2)                                             | 10          |
|                        | A12           | POWER SUPPLY UNIT                                                | 11          |
|                        | A13           | BUS INTERCONNECTIONS                                             | 12          |
|                        | A20           | LINE FILTER                                                      | 13          |
|                        | A21           | CRT SOCKET                                                       | 13          |
| COM 7101A              | A14           | SUB CPU (1/2)                                                    | 14          |
|                        | A14           | SUB CPU (2/2)                                                    | 15          |
|                        | A15           | SIGNAL PICKOFF FOR A/D CONVERTER,<br>CHANNEL DIVIDER & PEAK HOLD | 16          |
|                        | A16           | A/D CONVERTER & MEMORY                                           | 17          |
|                        | A17           | AQUISITION CONTROL                                               | 18          |
|                        | A18           | DISPLAY CONTROL (1/2)                                            | 19          |
|                        | A19           | DISPLAY CONTROL (2/2)                                            | 20          |
|                        | A19, A23, A24 | GP-IB INTERCONNECTIONS                                           | 21          |

Table 6-1 List of Circuit Diagrams



6.1.2 Notes for circuit diagram

Table 6-2 explains the omitted units and capacities of the parts in the circuit diagram.

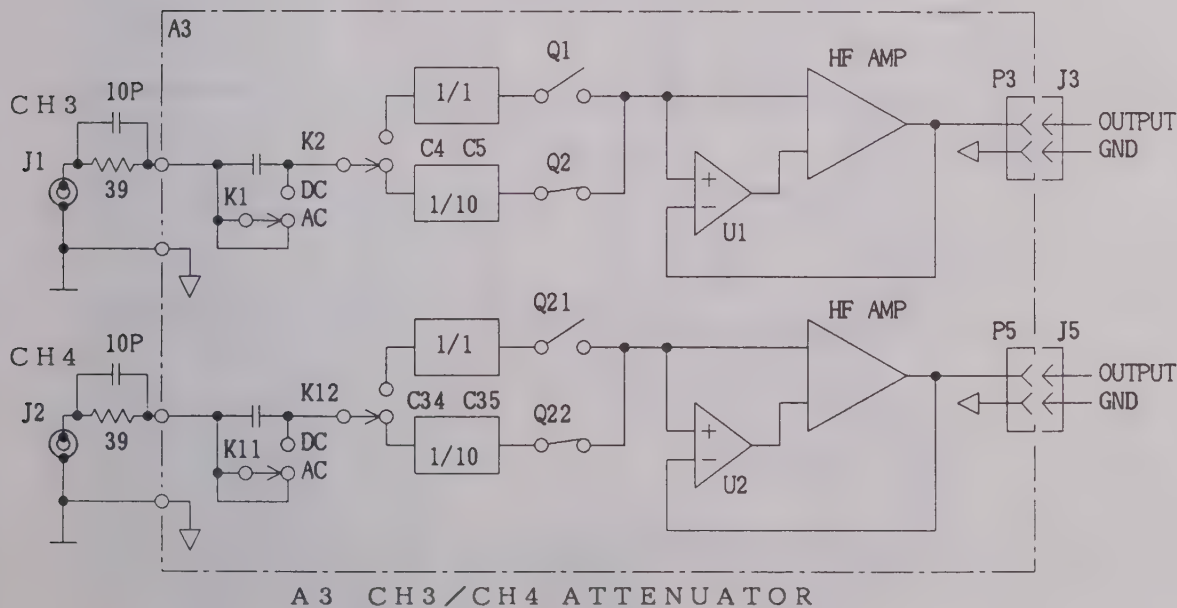
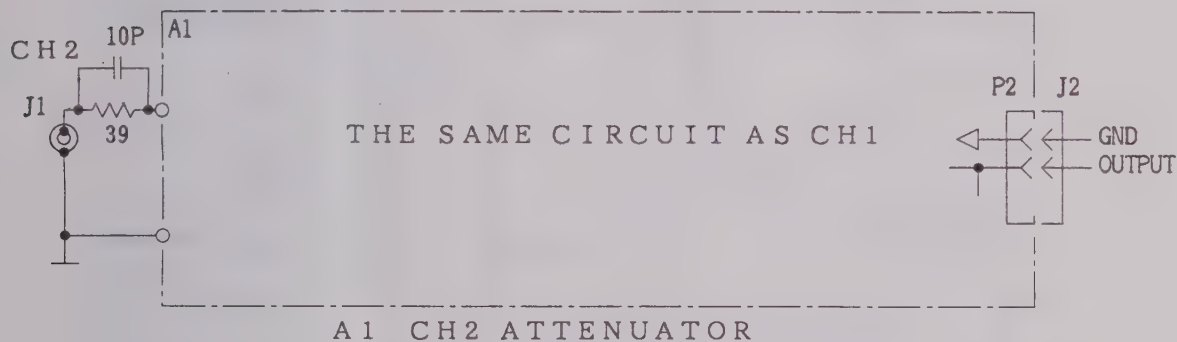
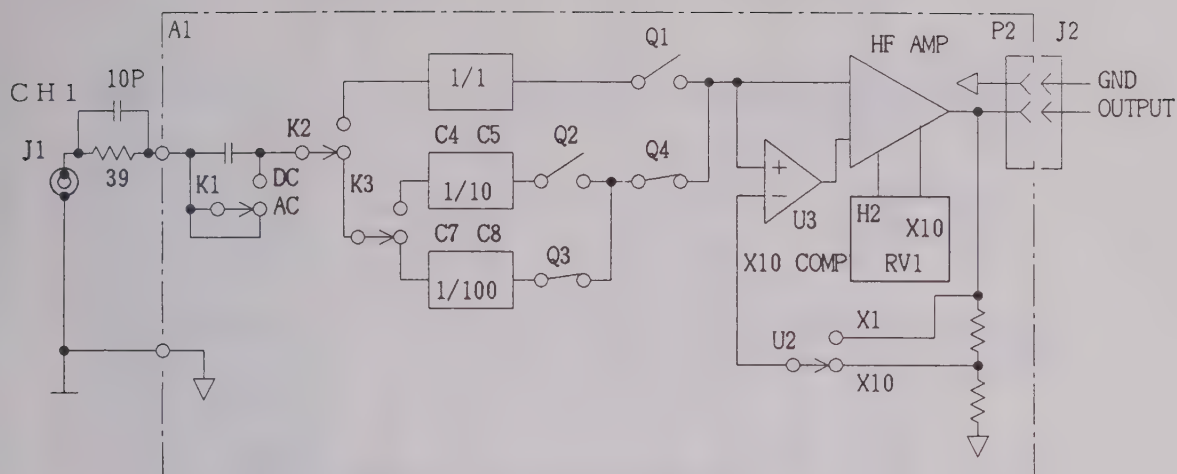
| Parts Name | Omitted Unit   | Omitted Capacity                                                                                                                        |
|------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Resistor   | $\Omega$ (ohm) | Unless otherwise specified, resistance value accuracy is $\pm 5\%$ , carbon film resistor. Refer to the parts list for tolerance power. |
| Capacitor  | F (Farad)      | Refer to the parts list for details.                                                                                                    |
| Inductance | H (Henry)      | Refer to the parts list for details.                                                                                                    |

Table 6-2 List of Omitted Units and Capacities

Table 6-3 also explains the special symbols using in the circuit diagram.

| Symbol                                                                            | Description                                                             |
|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------|
|  | Indicates metal film resistor.                                          |
|  | Indicates semi-fixed adjustment resistor and capacitor inside the case. |
|  | Indicates semi-fixed resistor adjustable from the outside.              |
|  | Typical value is shown. Actual value may differ.                        |

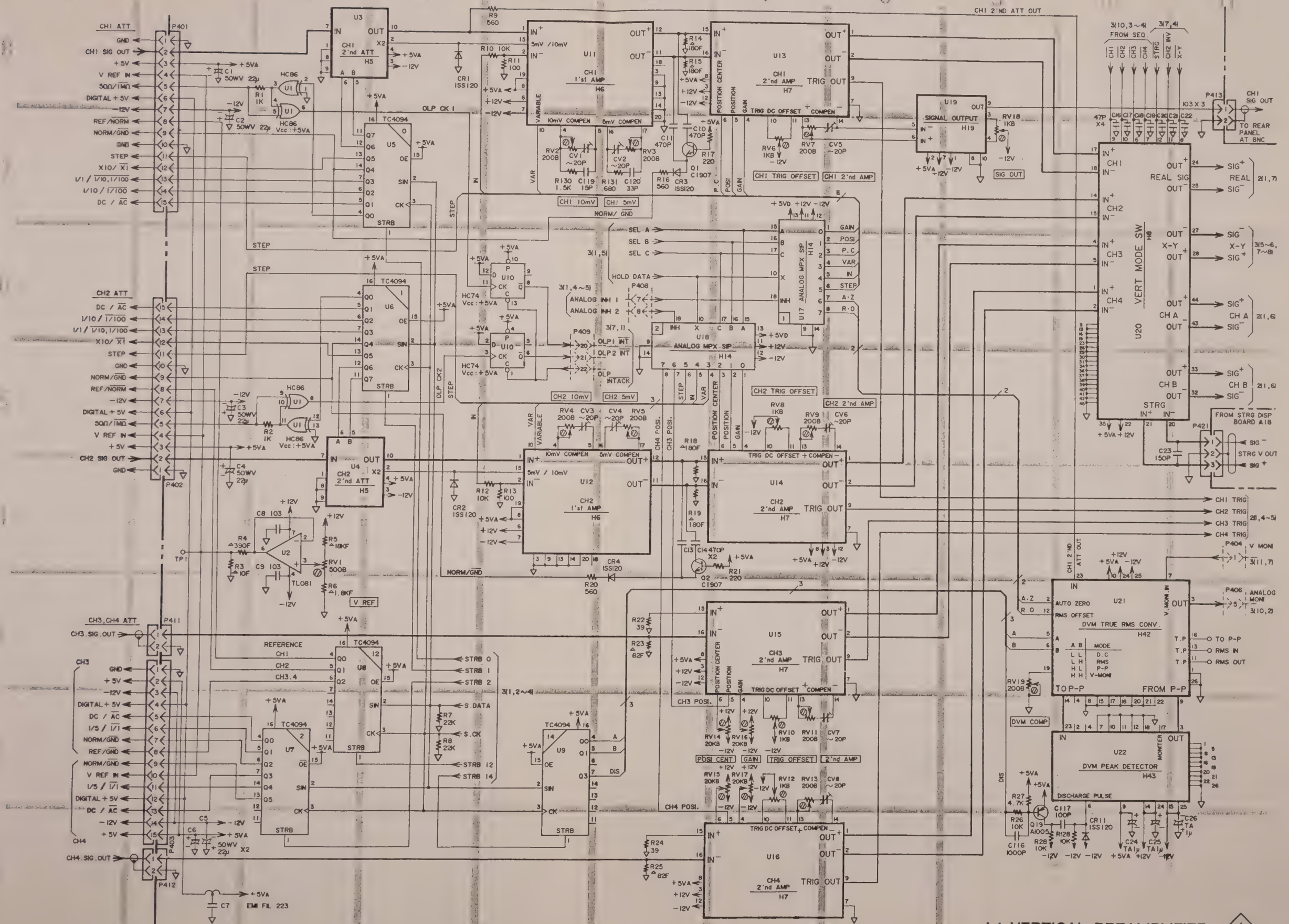
Table 6-3 Special Symbol and its Description



A1 CH1, CH2 ATTENUATOR  
A3 CH3, CH4 ATTENUATOR





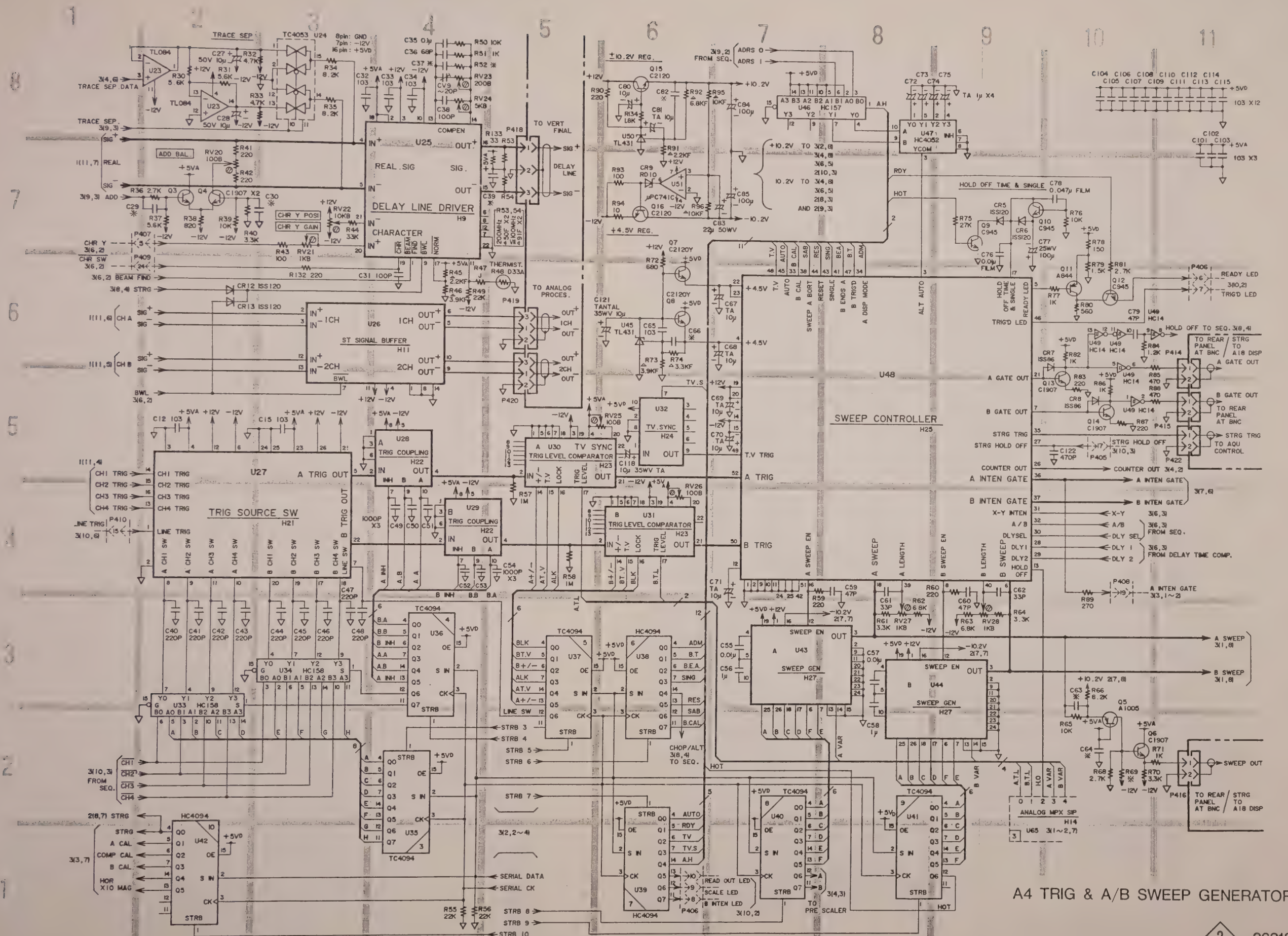












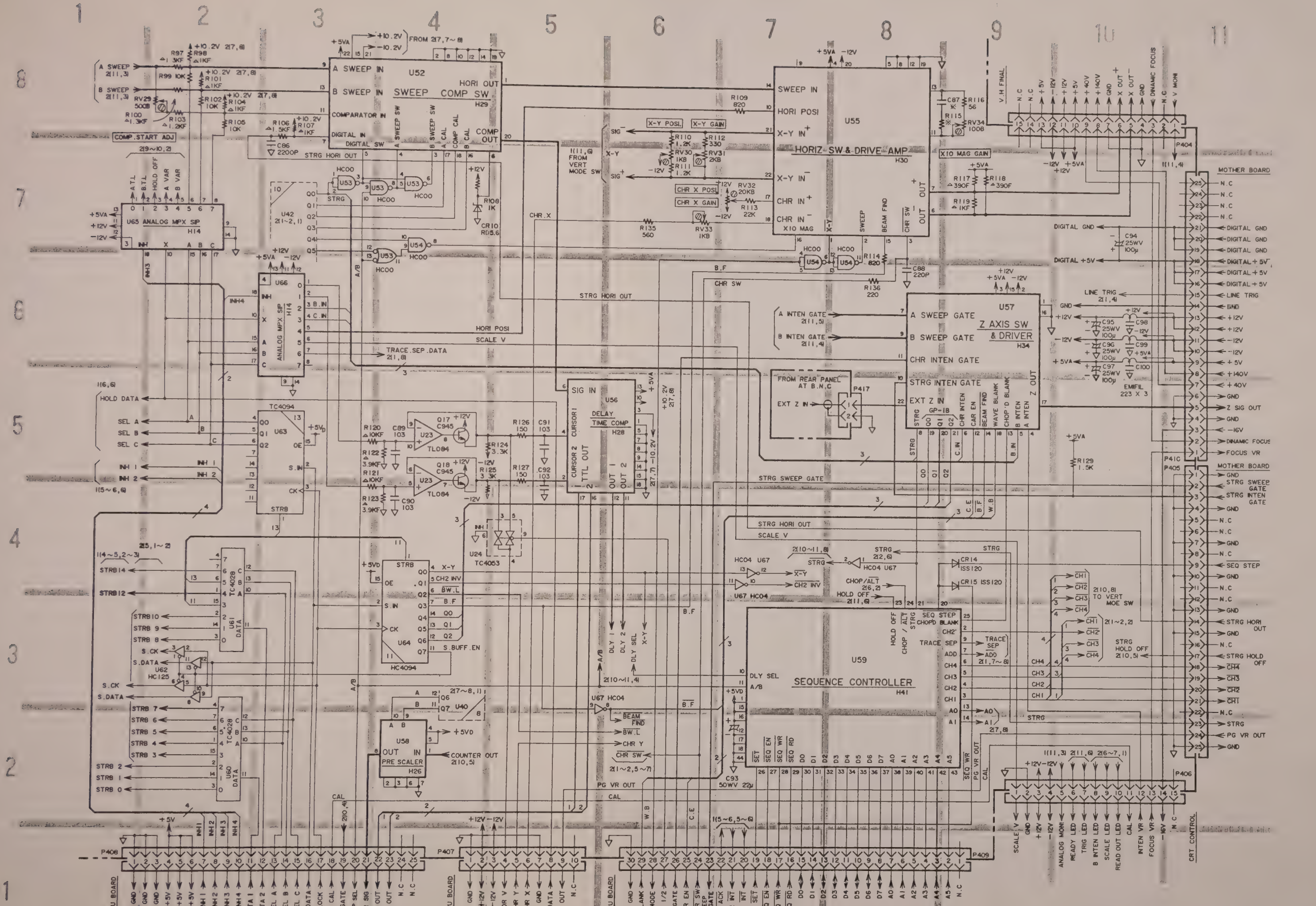
A4 TRIG & A/B SWEEP GENERATOR









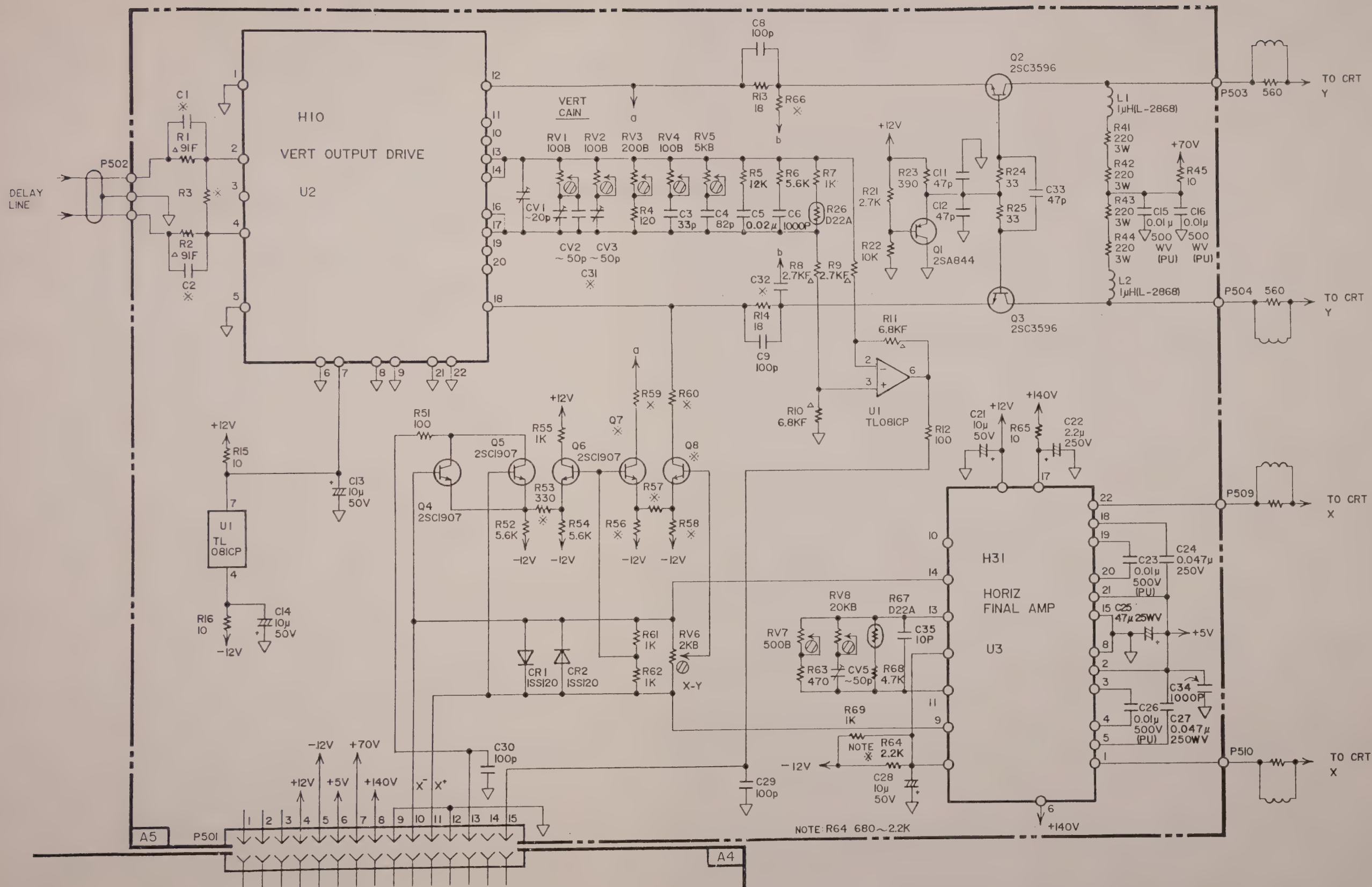










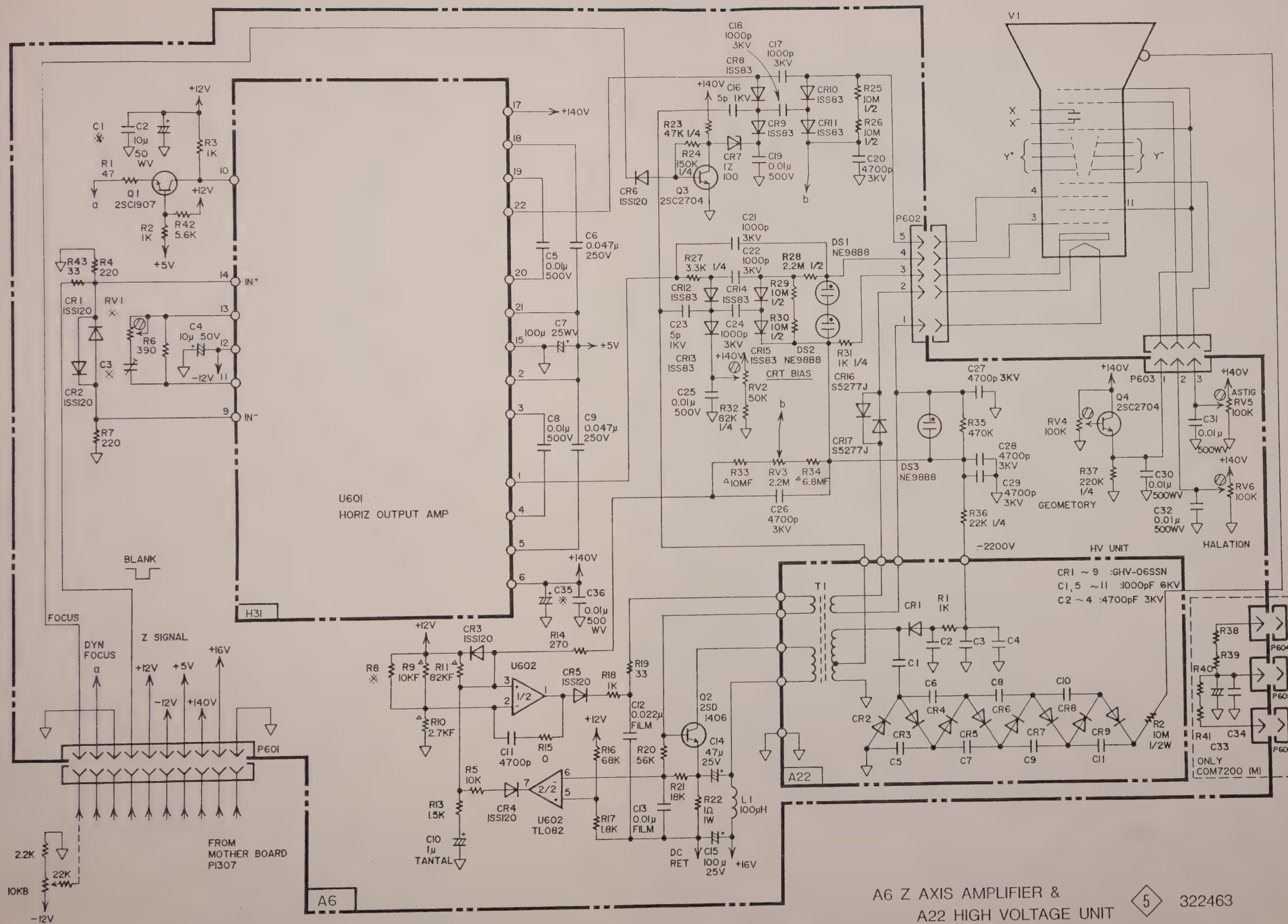










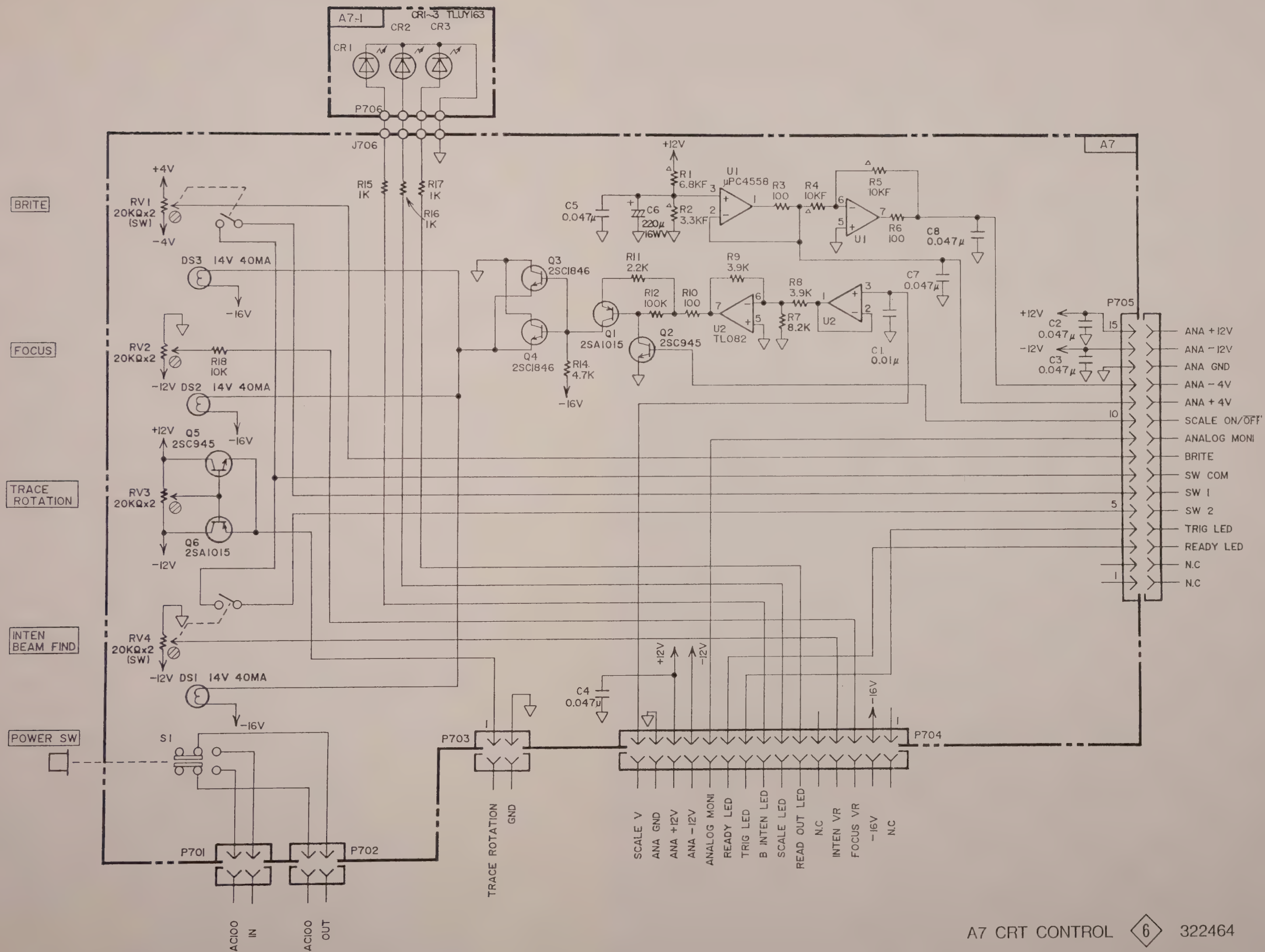




















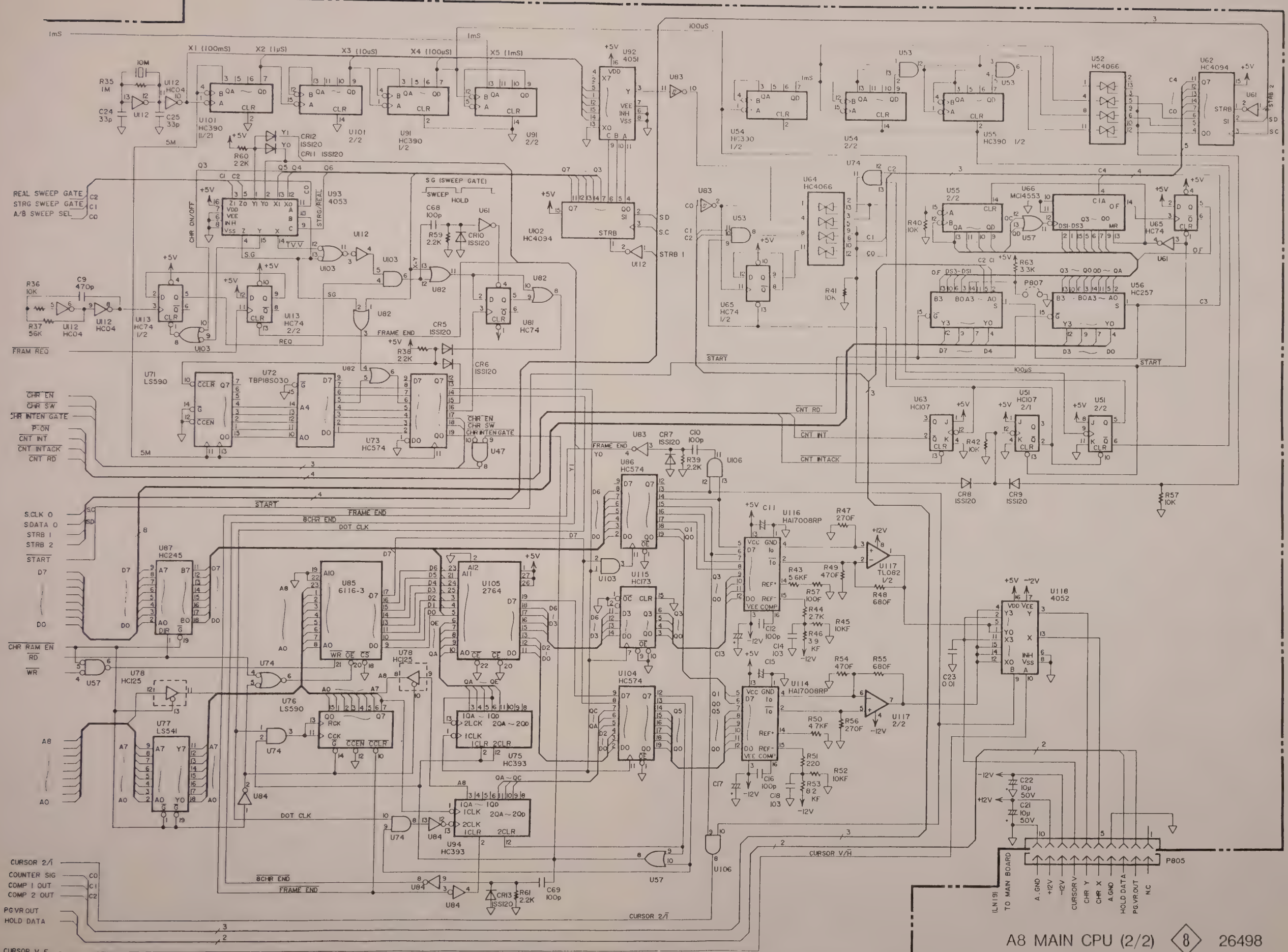




















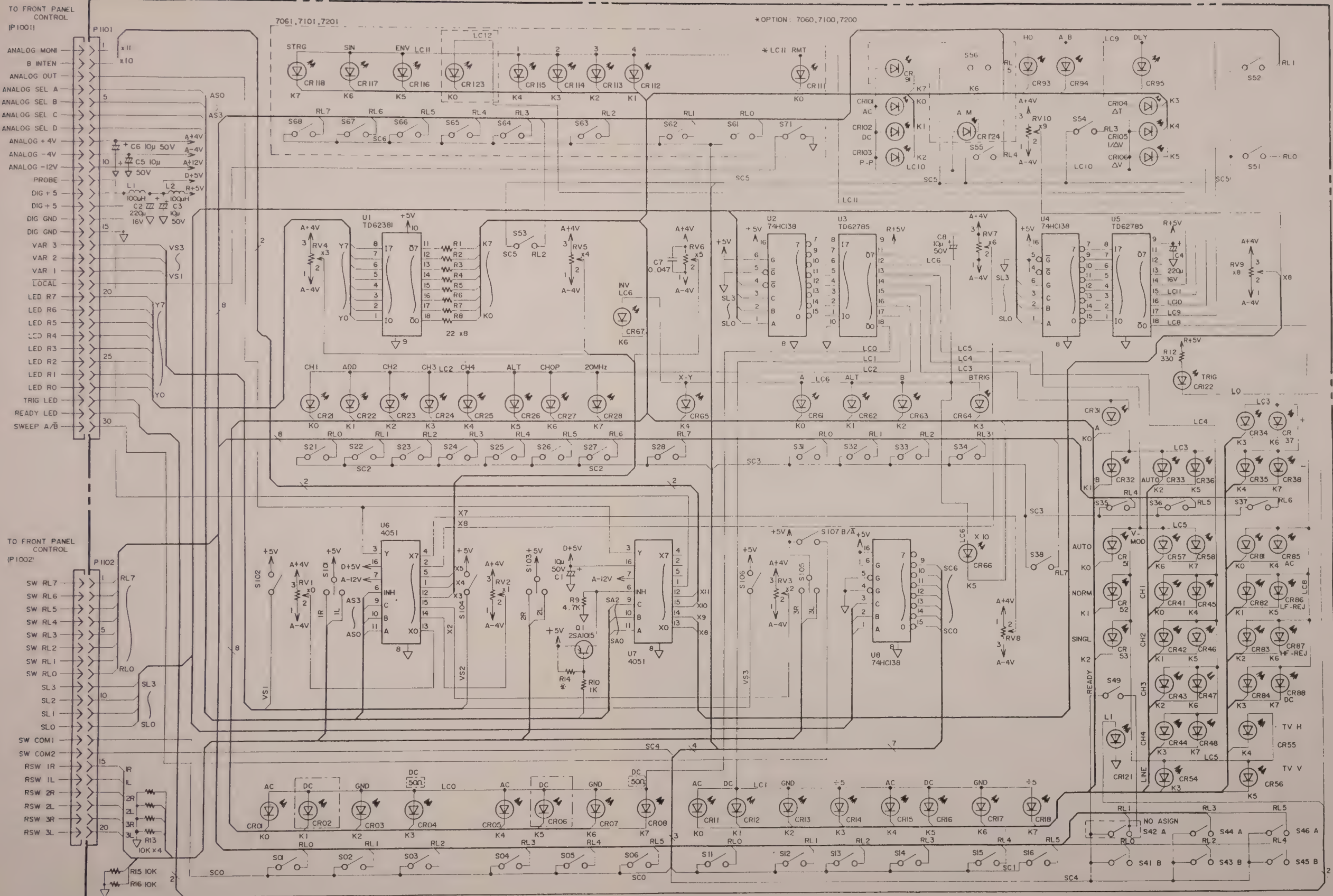










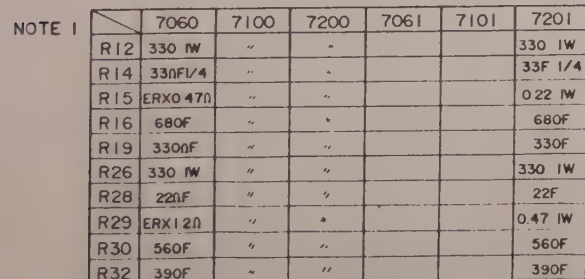












| NOTE 2 |                          |                        |                  |              |
|--------|--------------------------|------------------------|------------------|--------------|
|        | 7060<br>7100             | 7200                   | 7061 I<br>7101   | 7201         |
| T2     | T3W<br>YELLOW<br>BLACK * | T28<br>YELLOW<br>RED * | T48L II<br>WHITE | T5R<br>BLUE  |
| T3     | T1Y<br>YELLOW            | T1Y<br>YELLOW          | T6G<br>GREEN     | T6G<br>GREEN |

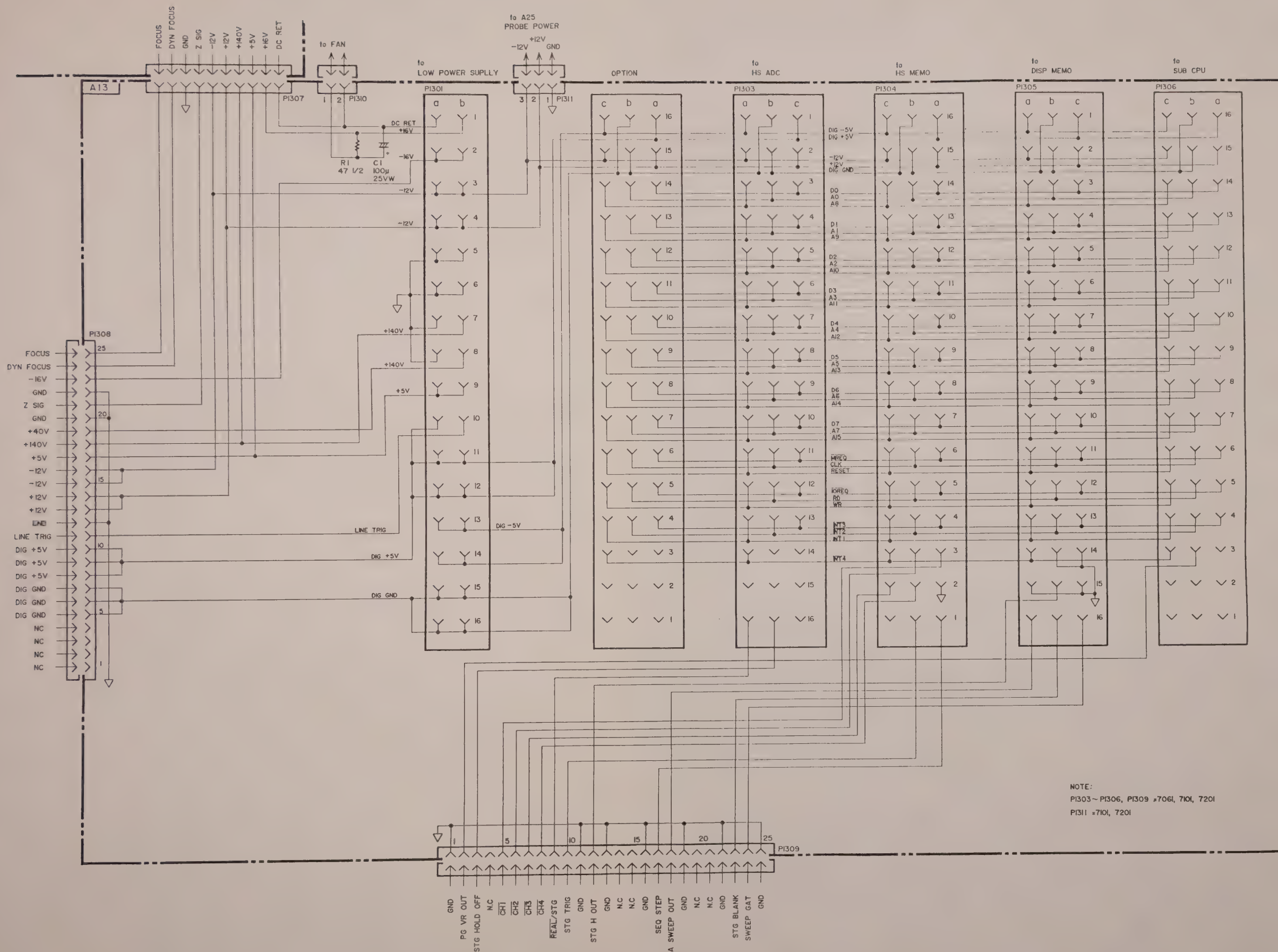
## A12 POWER SUPPLY UNIT









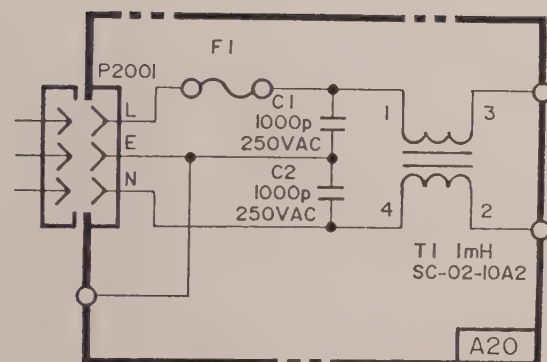




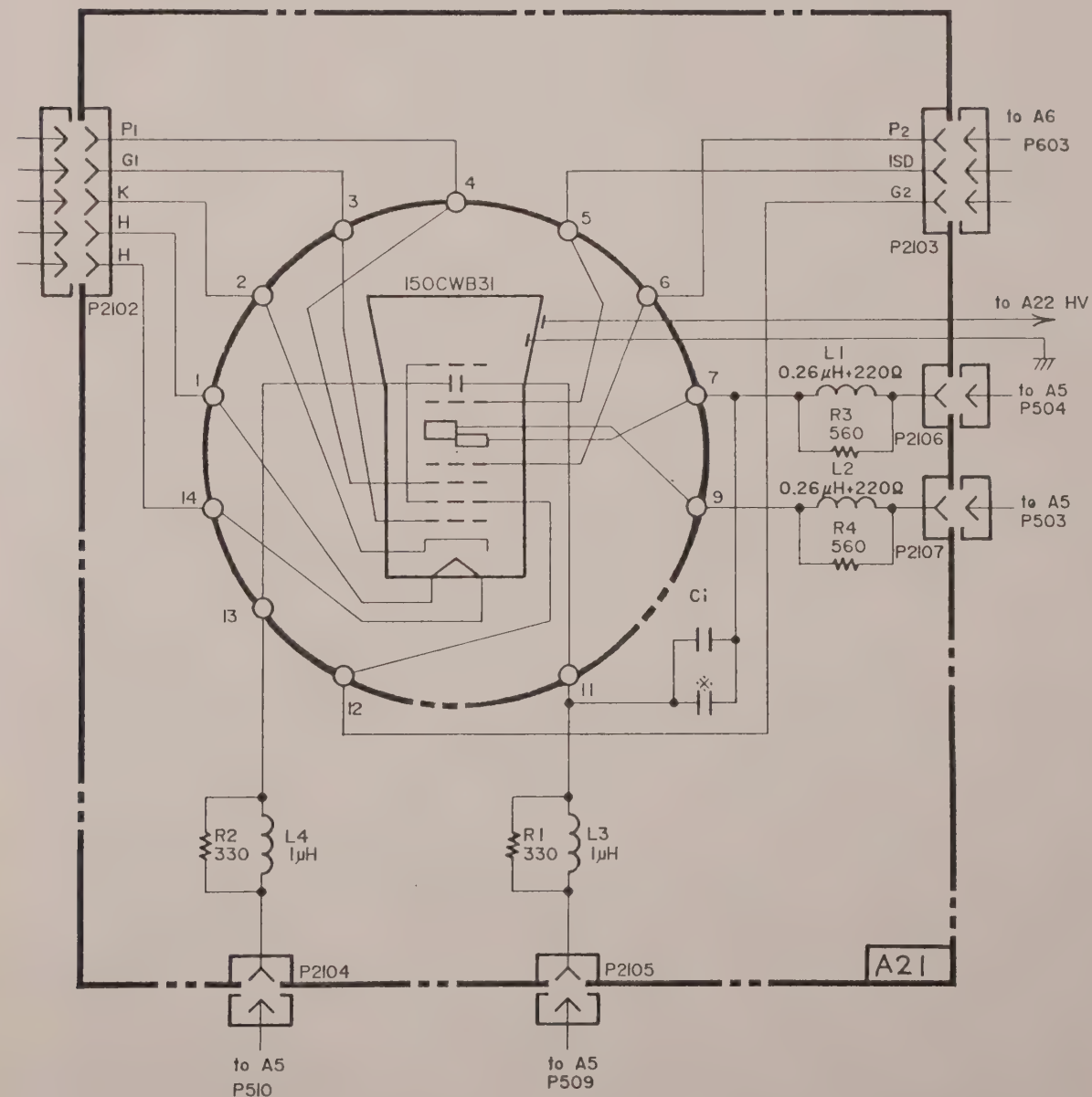








to A6  
Z AXIS AMP  
and H.V  
P602



※= PART OF ETCHED CIRCUIT BOARD









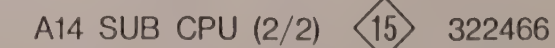










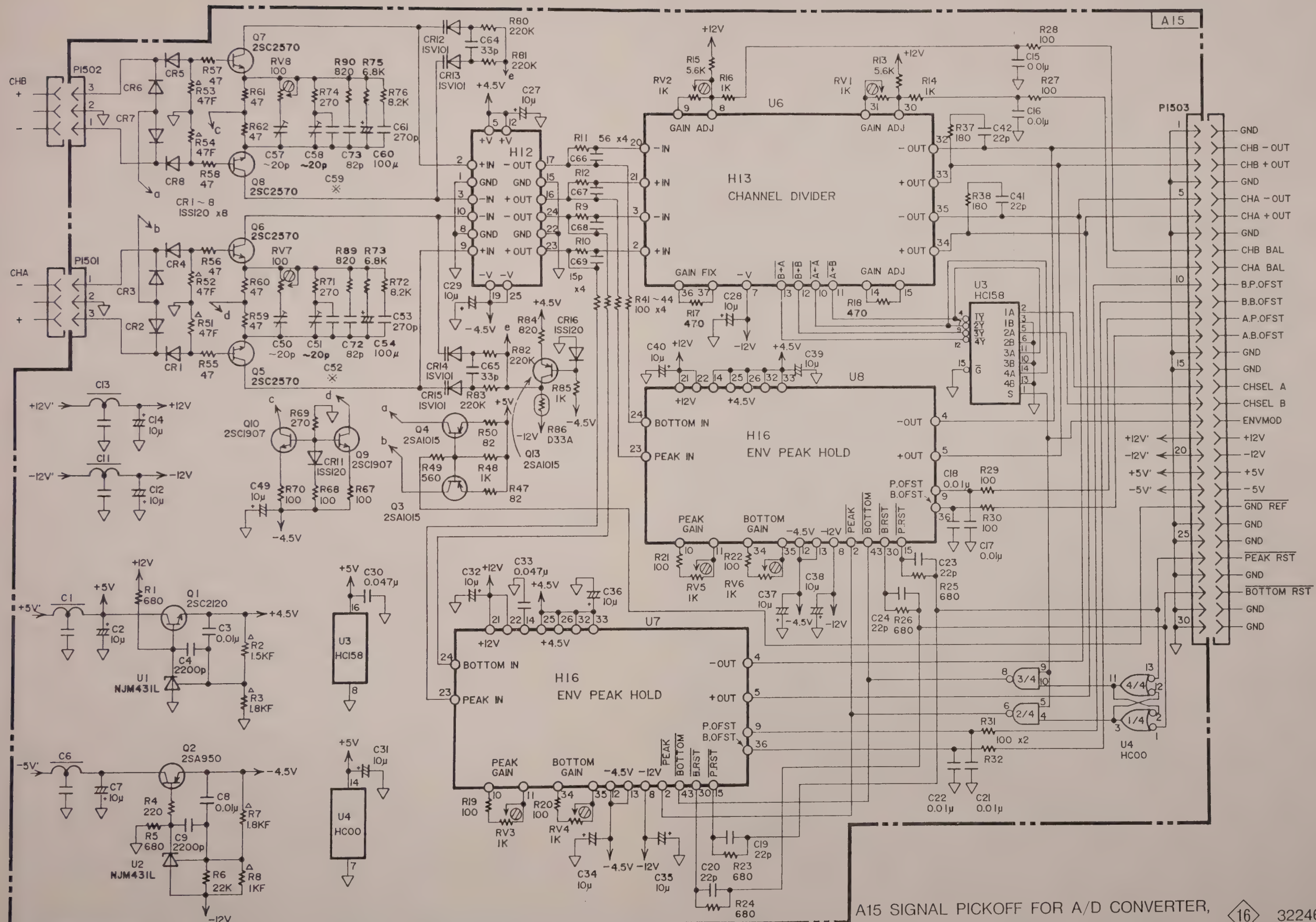












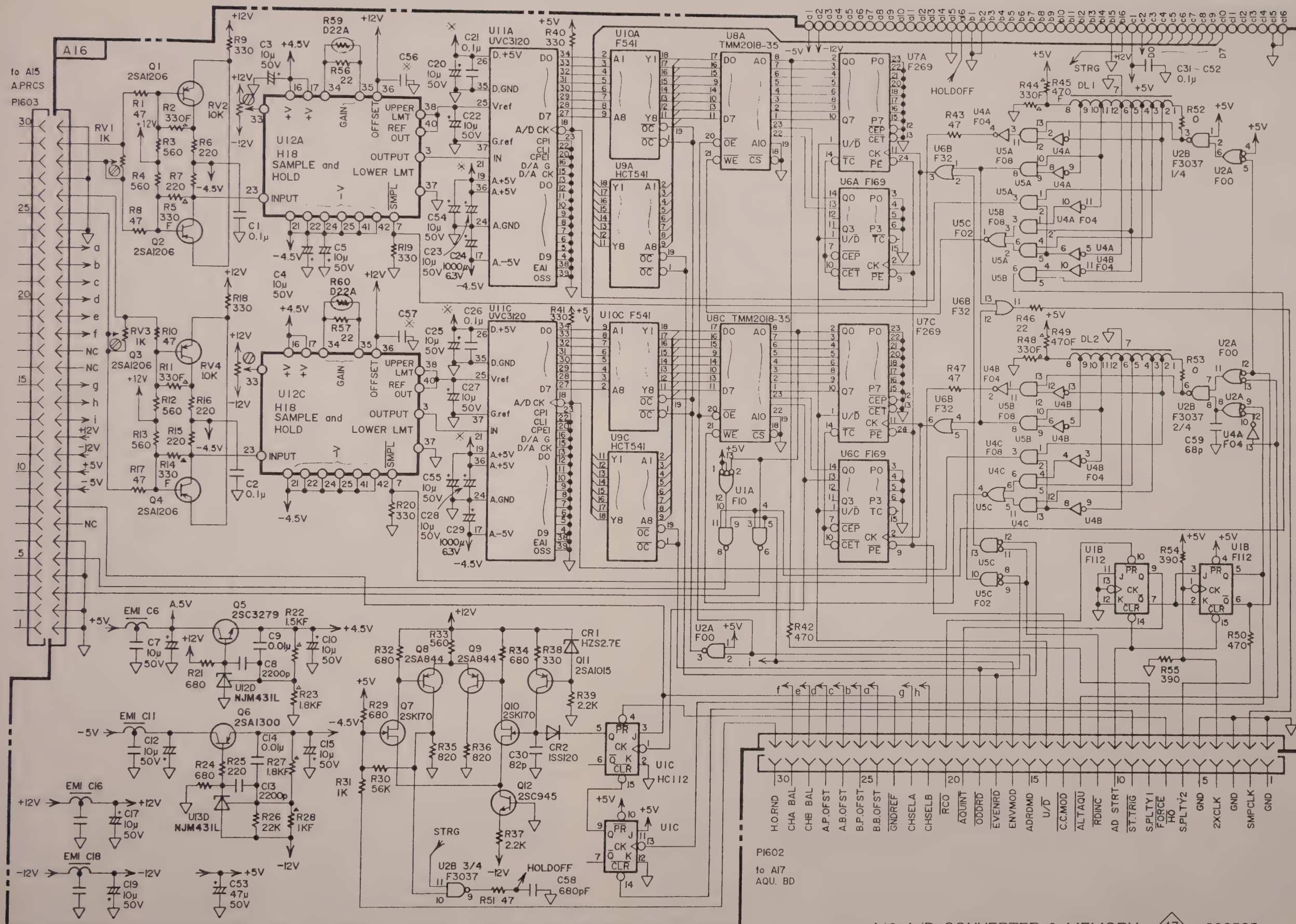
A15 SIGNAL PICKOFF FOR A/D CONVERTER,  
CHANNEL DIVIDER & PEAK HOLD









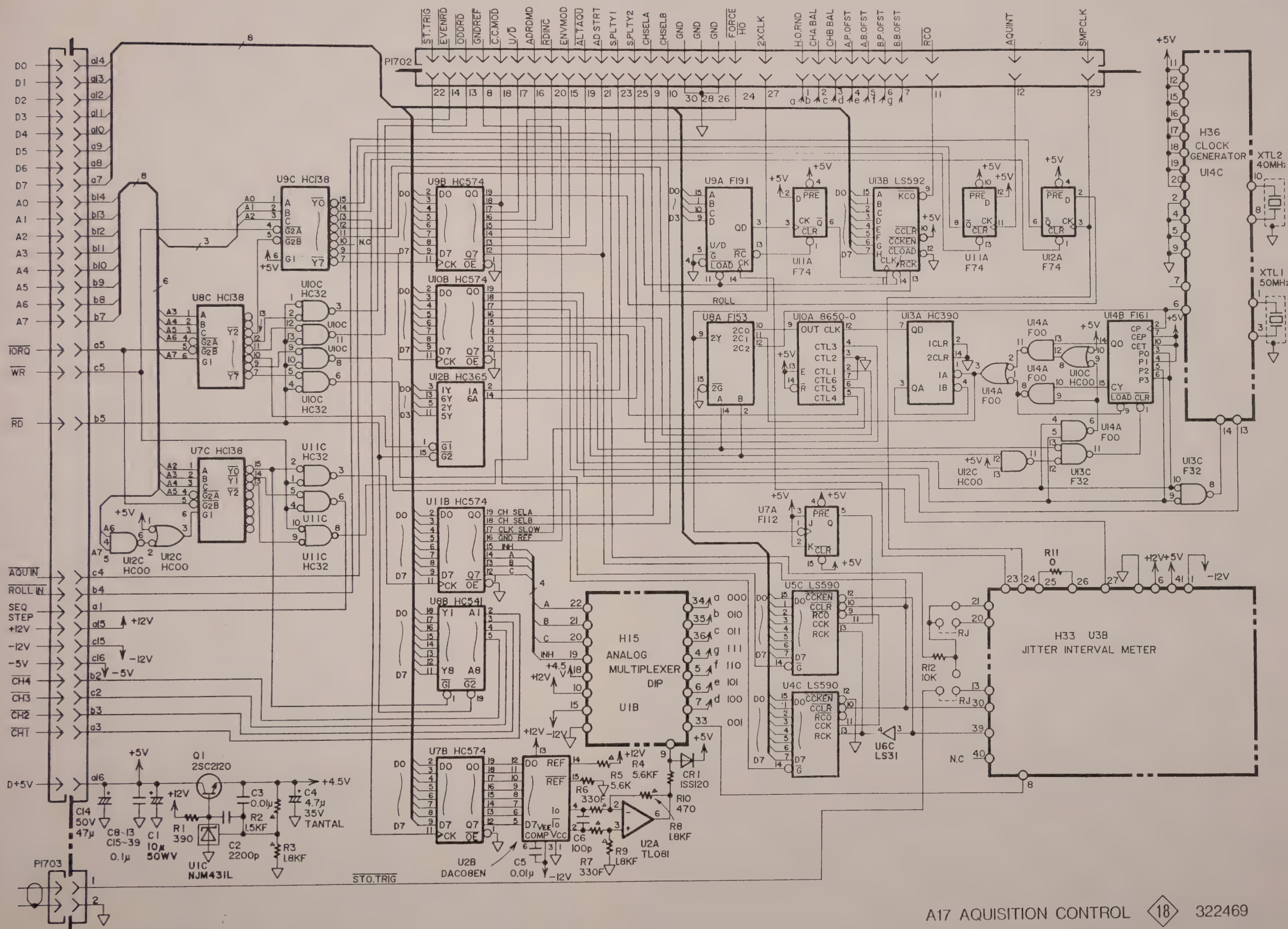




















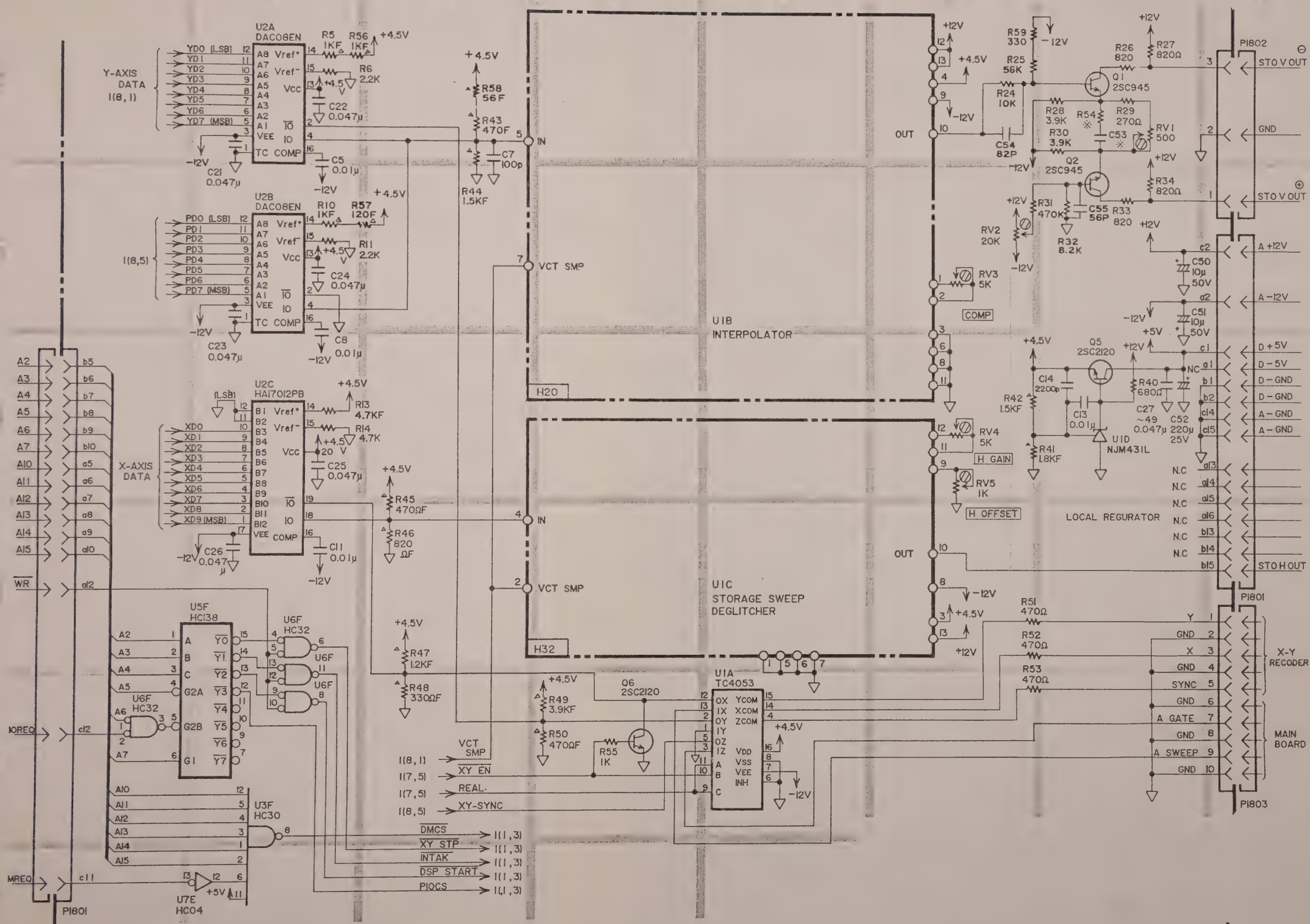










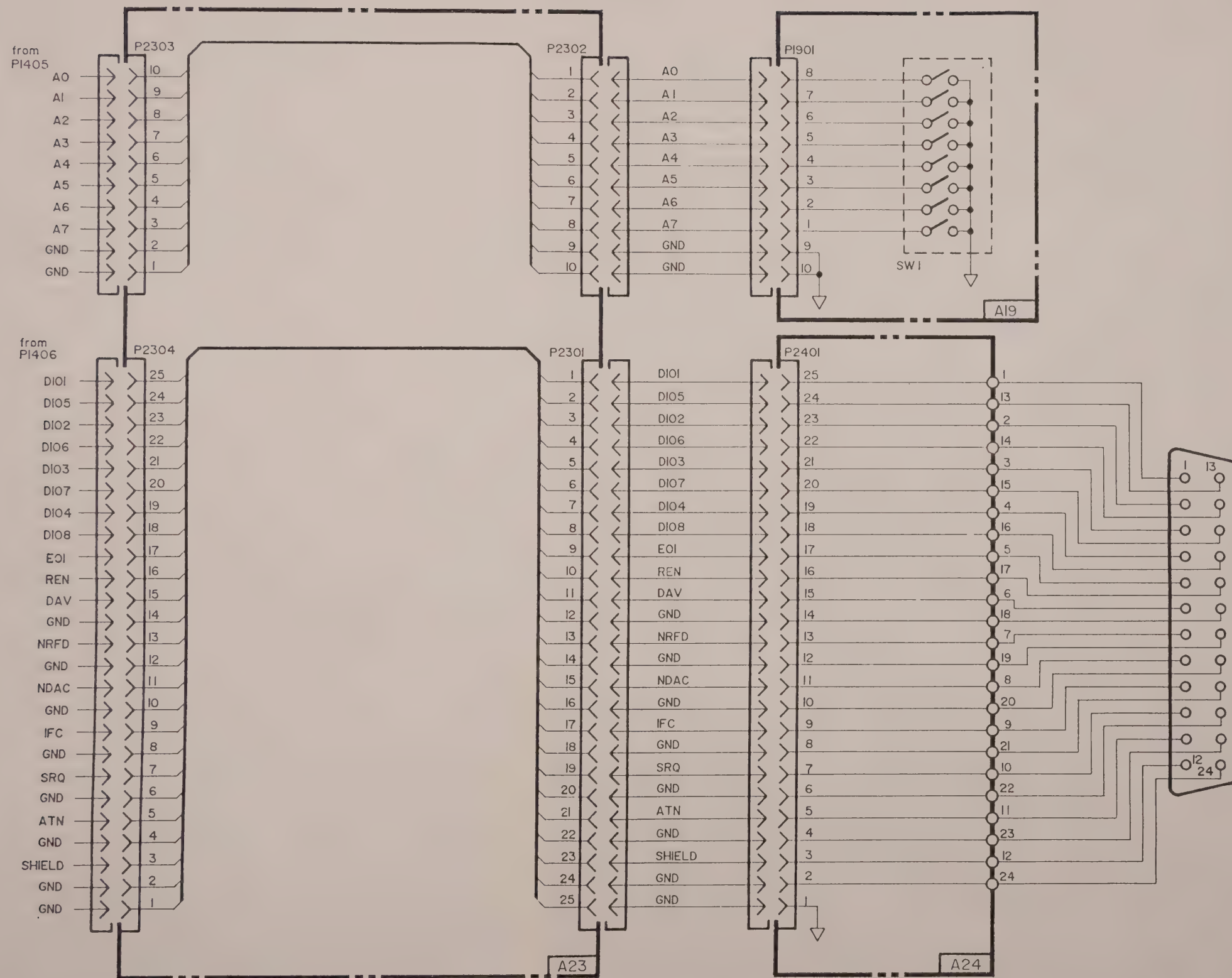
















## 6. 3 PARTS LOCATION

This section describes location of the parts on the boards used in the oscilloscope. Table 6-4 shows the list of each boards.

| CODE NO.   | NAME                                                                 | MODEL          | Page |
|------------|----------------------------------------------------------------------|----------------|------|
| 90-50-4320 | A4 MAIN BOARD                                                        | COM7101A/7100A | 6-45 |
| 90-50-4240 | A5 VERT & HORIZONTAL OUTPUT AMPLIFIER                                | COM7101A/7100A | 6-47 |
| 90-50-4250 | A6 Z-AXIS AMPLIFIER                                                  | COM7101A/7100A | 6-47 |
| 90-50-4260 | A7 CRT CONTROL                                                       | COM7101A/7100A | 6-47 |
| 90-50-4260 | A8 MAIN CPU                                                          | COM7101A/7100A | 6-49 |
| 90-50-4280 | A10 PANEL CONTROLS (1/2)                                             | COM7101A/7100A | 6-49 |
| 90-50-4291 | A11 PANEL CONTROLS (2/2)                                             | COM7101A/7100A | 6-49 |
| 90-50-4350 | A12 POWER SUPPLY UNIT                                                | COM7101A/7100A | 6-51 |
| 90-50-4340 | A13 BUS INTERCONNECTIONS                                             | COM7101A/7100A | 6-51 |
| 90-50-4161 | A14 SUB CPU                                                          | COM7101A ONLY  | 6-53 |
| 90-50-4170 | A15 SIGNAL PICKOFF FOR A/D CONVERTER,<br>CHANNEL DIVIDER & PEAK HOLD | COM7101A ONLY  | 6-51 |
| 90-50-4192 | A16 A/D CONVERTER & MEMORY                                           | COM7101A ONLY  | 6-53 |
| 90-50-4201 | A17 AQUISITION CONTROL                                               | COM7101A ONLY  | 6-55 |
| 90-50-4210 | A18 DISPLAY CONTROL                                                  | COM7101A ONLY  | 6-55 |

Note : "CODE NO." in this list does not show assemble board.

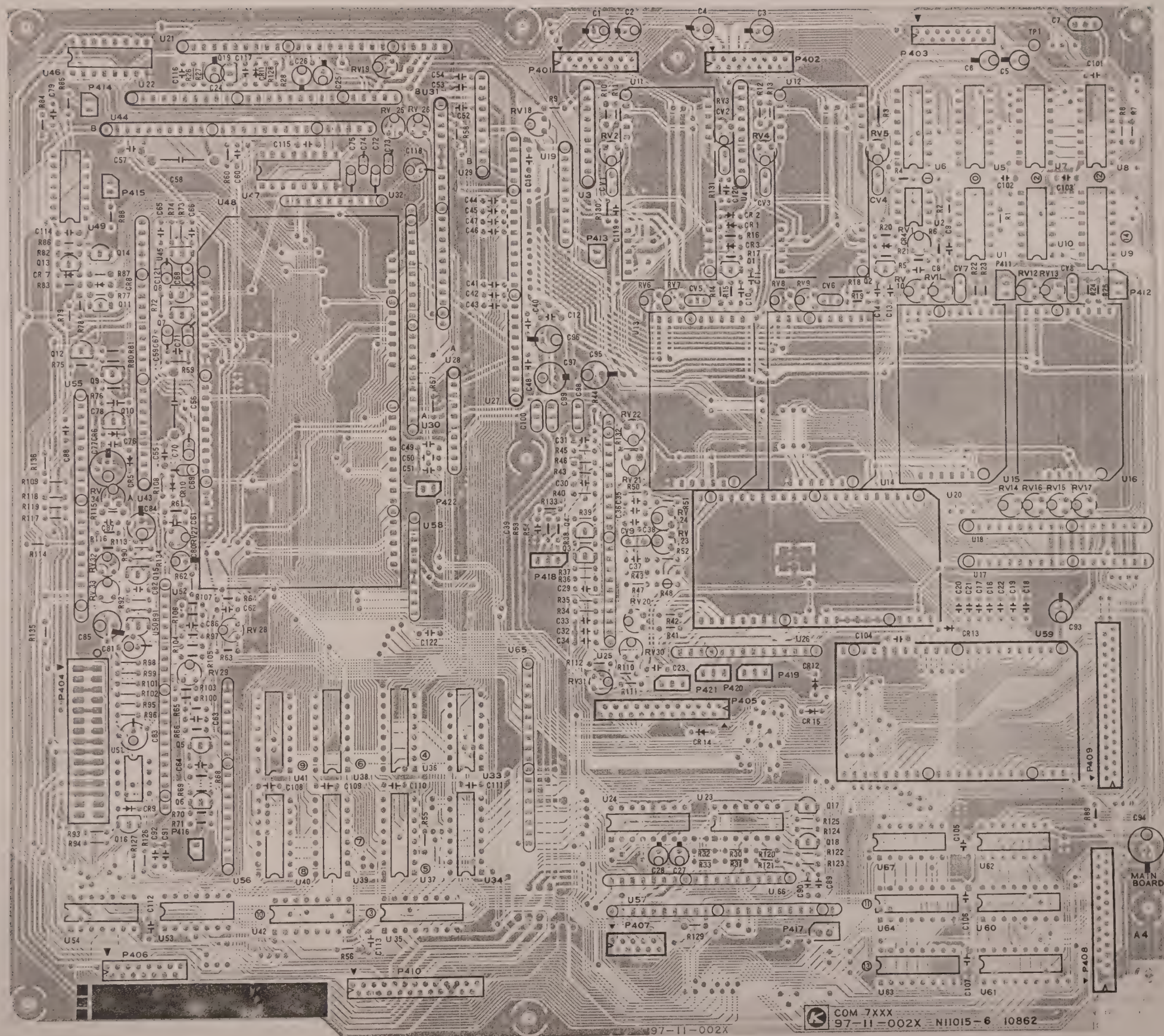
Table 6-4 List of each boards





A4 MAIN BOARD  
(Parts side view)

(Parts side view)























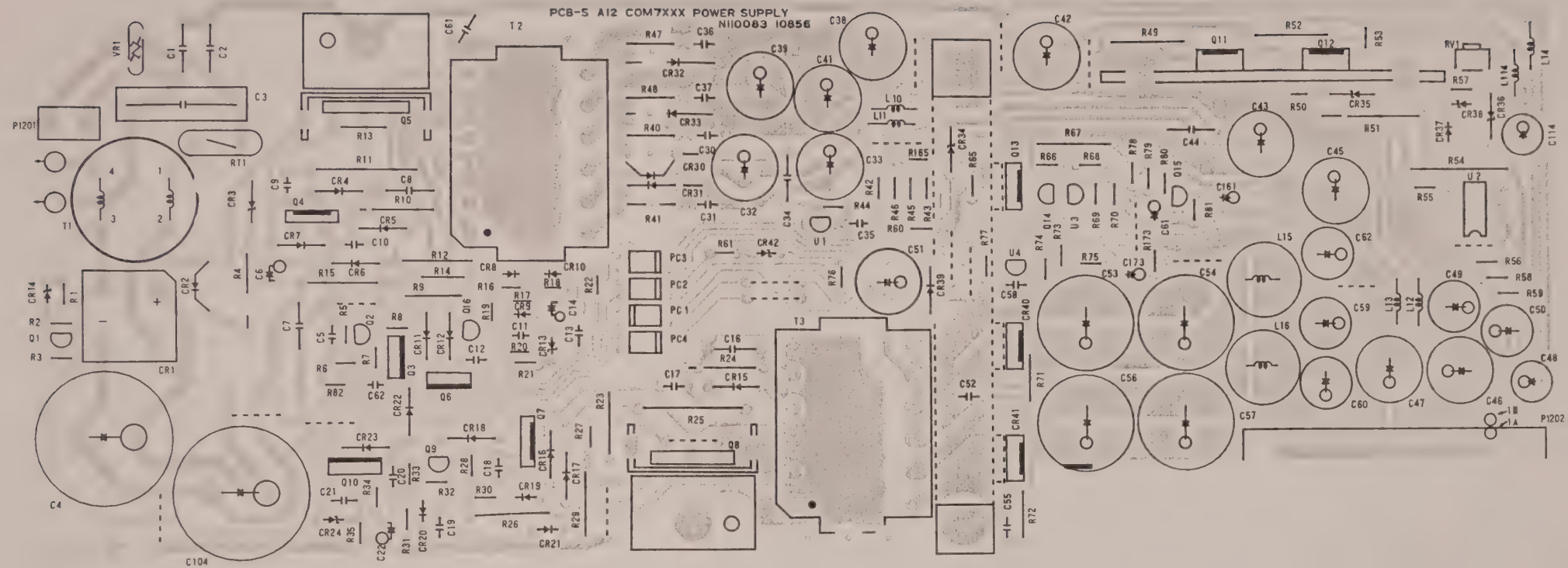




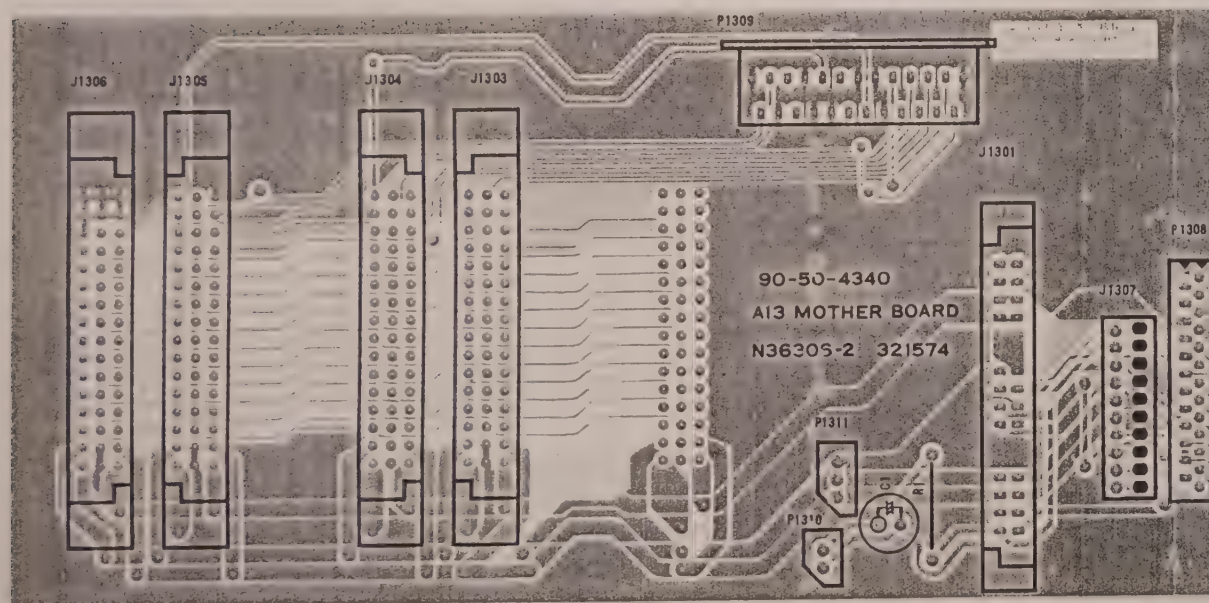




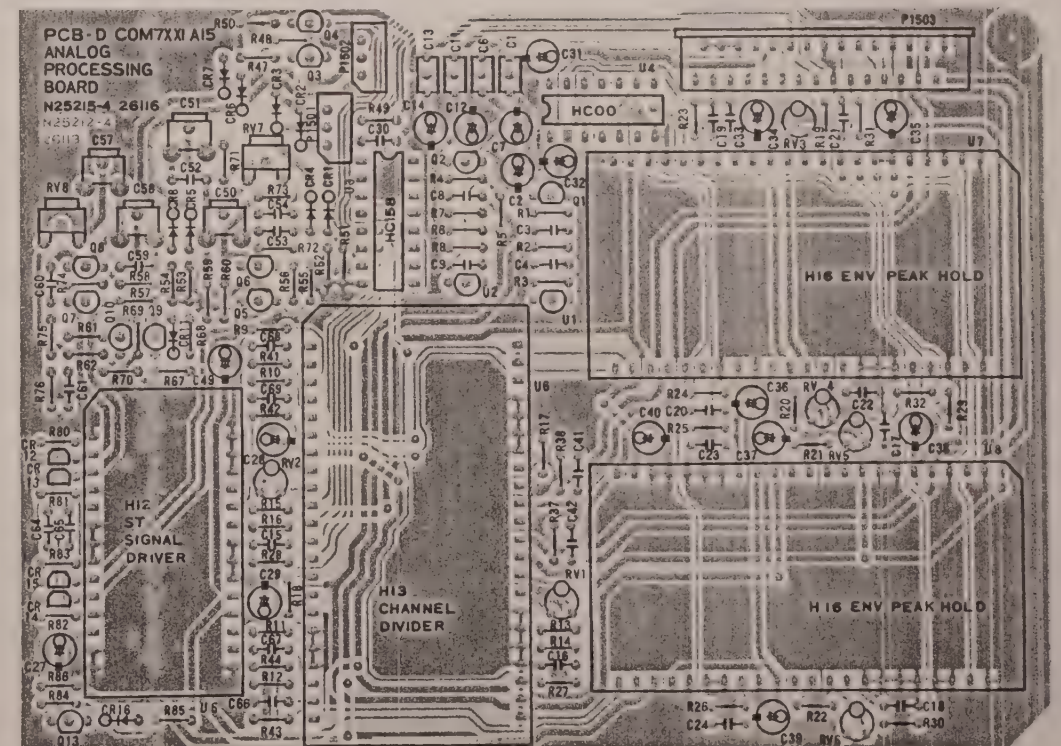




A12 POWER SUPPLY UNIT (Parts side view)



A13 BUS INTERCONNECTIONS (Parts side view)



A15 SIGNAL PICKOFF FOR A/D CONVERTER,  
CHANNEL DIVIDER & PEAK HOLD (Parts side view)

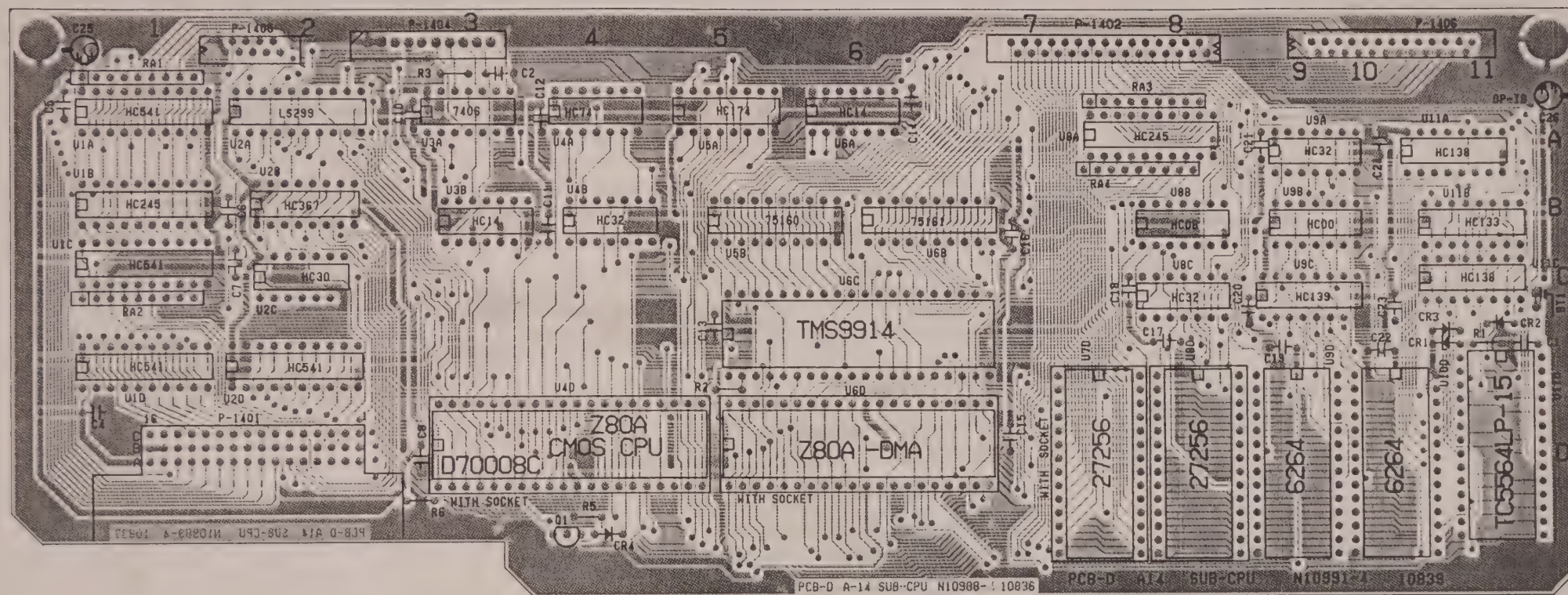




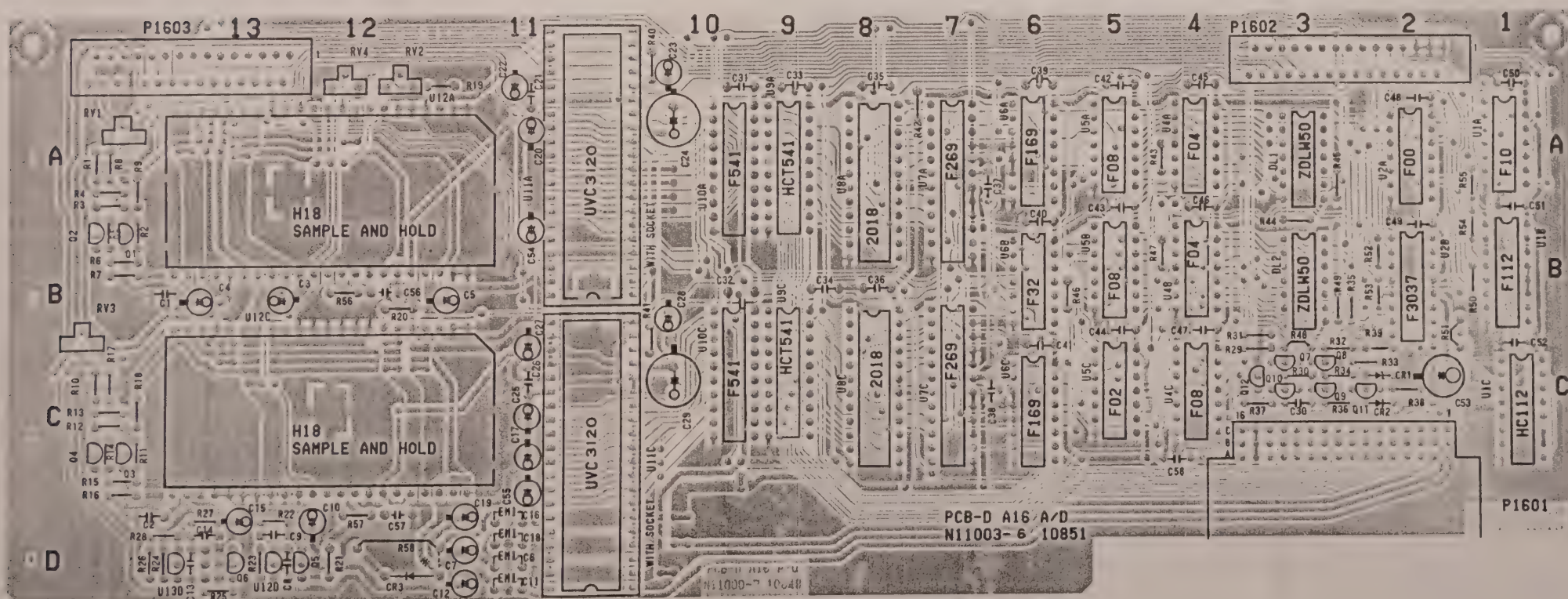








A14 SUB CPU (Parts side view)



A16 A/D CONVERTER & MEMORY (Parts side view)















# SECTION 7

## PARTS LIST



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| 7.1.2 COM7101A parts list .....   | 7-3  |
| 7.1.3 COM 7100A parts list .....  | 7-55 |





## 7. PARTS LIST

### 7.1 Parts List (Electronic)

#### 7.1.1 Description

This chapter shows the parts list (Electronic) classified by model and separated in each assembly (in board unit). When replacing the parts using in this unit for repairing, thoroughly understand the capacities described in the parts list, and use the same parts or equivalent ones.

If the parts are not available, or a damaged part is the exclusive one, please ask directly to our International Division. In this case be sure to specify the name of model, KIKUSUI PARTS NO., and the name parts Figure 7-1 explains how to read the parts list.

Example:

| REFERENCE<br>DESIGNATOR    | KIKUSUI<br>PARTS NO.      | DESCRIPTION                  | xx-xx-xxxx    |                                |
|----------------------------|---------------------------|------------------------------|---------------|--------------------------------|
| U6                         | 35-69-0010                | DUAL MONOSTABLE MULTI        | MOTOROLA      | MC14538BCP                     |
| Circuit diagram<br>number. | KIKUSUI's<br>Part Number. | Description of<br>the Parts. | Manufacturer. | Manufacturer's<br>Part Number. |

Figure 7-1 How to Read the Parts List

#### \* About the KIKUSUI PART NUMBER.

KIKUSUI classifies the code of electronic parts as in Table 7-1 shows.

| Code No.   | Classification                          | Description                               |
|------------|-----------------------------------------|-------------------------------------------|
| 2x-xx-xxxx | Electronic tube                         | CRT, neon tube, etc.                      |
| 3x-xx-xxxx | Semiconductor                           | Transistor, FET, diode, IC, etc.          |
| 4x-xx-xxxx | Resistor                                | Fixed resistor, semi-fixed resistor, etc. |
| 5x-xx-xxxx | Capacitor                               | Electrolytic, ceramic, polystyrene, etc.  |
| 6x-xx-xxxx | Electromagnetic parts (Stationary type) | Transformer, choke coil, etc.             |
| 7x-xx-xxxx | Electromagnetic parts (Movable type)    | Meter, relay, etc.                        |
| 8x-xx-xxxx | Contact parts                           | Switch, connector, socket, etc.           |
| 9x-xx-xxxx | Others                                  | PC board, wire, fuse, etc.                |

Table 7-1 Code Number Classification and Description

\* About the abbreviation of description.

The certain words in the description are using abbreviations. Table 7-2 is the list of abbreviations.

| Abbreviation | Description             | Abbreviation | Description            |
|--------------|-------------------------|--------------|------------------------|
| CER          | CERAMIC                 | M FILM       | METAL FILM             |
| C FILM       | CARBON FILM             | M GLAZE      | METAL GLAZE            |
| C COMP       | CARBON COMPOSITION      | M OX         | METAL OXIDE            |
| CRT          | CATHODE RAY TUBE        | M PLSTC FILM | METALIZED PLASTIC FILM |
| ELECT        | ELECTROLYTIC            | SI           | SILICON                |
| FET          | FIELD EFFECT TRANSISTOR | TANT ELECT   | TANTALUM ELECTROLYTIC  |
| FXD          | FIXED                   | VAR          | VARIABLE               |
| LED          | LIGHT EMITTING DIODE    | WW           | WIRE WOUND             |

Table 7-2 List of Abbreviations

\* About the manufacturer.

Some manufacturers are using abbreviations for their names. Table 7-3 is the list of the abbreviations.

| Abbreviation | Name of Manufacturer       | Abbreviation | Name of Manufacturer |
|--------------|----------------------------|--------------|----------------------|
| B.B          | BURR-BROWN RESEARCH        | SANKEN       | SANKEN               |
| FAIRCHILD    | FAIRCHILD                  | SANYO        | SANYO                |
| FUJIDENKI    | FUJIDENKI                  | SIGNETICS    | SIGNETICS            |
| FUJITSU      | FUJITSU                    | SILICONIX    | SILICONIX            |
| HITACHI      | HITACHI                    | SINDENGEN    | SHINDENGEN           |
| ITT          | ITT SEMICONDUCTOR          | SHARP        | SHARP                |
| NEC          | NEC ELECTRON               | SONY         | SONY                 |
| MATSUSHITA   | PANASONIC                  | TEXAS INS.   | TEXAS INSTRUMENTS    |
| MOTOROLA     | MOTOROLA SEMICONDUCTOR     | TOSHIBA      | TOSHIBA              |
| N. INTER     | NIHON INTER                | TRW          | TRW                  |
| N.S.         | NATIONAL SEMICONDUCTOR     |              |                      |
| PMI          | PRECISION MONOLITHICS, INC |              |                      |
| RCA          | RCA                        |              |                      |

Table 7-3 List of Manufacturers

### 7.1.2 COM 7101A Parts List

Table 7-4 shows each parts used for COM 7101A by assembly.

| Assembly     | CODE NO.   | Description                                                                                                                  |
|--------------|------------|------------------------------------------------------------------------------------------------------------------------------|
| B ASSEMBLY   |            | Parts used for Chassis.                                                                                                      |
| A1 ASSEMBLY  | 36-00-1030 | Parts used for CH1 and CH2 ATTENUATOR boards. Note that the chip parts are not included.                                     |
| A3 ASSEMBLY  | 36-00-1040 | Parts used for CH3 and CH4 ATTENUATOR boards. Note that the chip parts are not included.                                     |
| A4 ASSEMBLY  | 97-11-0230 | Parts used for MAIN board. (VERTICAL PREAMPLIFIER, TRIG & A/B SWEEP GENERATOR and HORIZONTAL SWITCH & Z AXIS CONTROL board.) |
| A5 ASSEMBLY  | 97-11-0030 | Parts used for VERTICAL & HORIZONTAL OUTPUT AMPLIFIER board.                                                                 |
| A6 ASSEMBLY  | 97-11-0040 | Parts used for Z AXIS AMPLIFIER board.                                                                                       |
| A7 ASSEMBLY  | 97-11-0050 | Parts used for CRT CONTROL board.                                                                                            |
| A8 ASSEMBLY  | 97-11-0060 | Parts used for MAIN CPU board.                                                                                               |
| A10 ASSEMBLY | 97-11-0070 | Parts used for PANEL CONTROLS (1/2) board.                                                                                   |
| A11 ASSEMBLY | 97-11-0261 | Parts used for PANEL CONTROLS (2/2) board.                                                                                   |
| A12 ASSEMBLY | 97-11-0280 | Parts used for POWER SUPPLY UNIT board.                                                                                      |
| A13 ASSEMBLY | 97-11-0250 | Parts used for BUS INTERCONNECTIONS board.                                                                                   |
| A14 ASSEMBLY | 97-11-0121 | Parts used for SUB CPU board.                                                                                                |
| A15 ASSEMBLY | 97-11-0170 | Parts used for SIGNAL PICKOFF FOR A/D CONVERTER, CHANNEL DIVIDER & PEAK HOLD board.                                          |
| A16 ASSEMBLY | 97-11-0150 | Parts used for A/D CONVERTER & MEMORY board.                                                                                 |
| A17 ASSEMBLY | 97-11-0140 | Parts used for AQUISITION CONTROL board.                                                                                     |
| A18 ASSEMBLY | 97-11-0130 | Parts used for DISPLAY CONTROL board.                                                                                        |
| A20 ASSEMBLY | 97-11-0110 | Parts used for LINE FILTER board.                                                                                            |
| A22 ASSEMBLY | 97-11-0200 | Parts used for HIGH VOLTAGE UNIT board.                                                                                      |

Table 7-4 List of ASSEMBLIES for COM 7101A



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION |
|-------------------------|----------------------|-------------|
|-------------------------|----------------------|-------------|

#### B ASSEMBLY

|    |            |                  |         |          |
|----|------------|------------------|---------|----------|
| V1 | 21-46-0614 | CATHODE RAY TUBE | TOSHIBA | 150CWB31 |
| ** | 66-21-0082 | ROTATION COIL    | KIKUSUI | S8607331 |
| ** | 76-52-0051 | FAN (DC 12V)     |         |          |

#### A1 ASSEMBLY (CH1)

|    |            |                          |         |          |
|----|------------|--------------------------|---------|----------|
| H3 | 36-00-1030 | HIC (H3 CH1,CH2 1ST ATT) | KIKUSUI | B0009/03 |
| J1 | 83-30-1190 | BNC CONNECTOR            |         | *1       |
| K1 | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *1       |
| K2 | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *1       |
| K3 | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *1       |

#### A1 ASSEMBLY (CH2)

|    |            |                          |         |          |
|----|------------|--------------------------|---------|----------|
| H3 | 36-00-1030 | HIC (H3 CH1,CH2 1ST ATT) | KIKUSUI | B0009/03 |
| J1 | 83-30-1190 | BNC CONNECTOR            |         | *1       |
| K1 | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *1       |
| K2 | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *1       |
| K3 | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *1       |

#### A3 ASSEMBLY

|     |            |                          |         |          |
|-----|------------|--------------------------|---------|----------|
| H4  | 36-00-1040 | HIC (H4 CH3/CH4 1ST ATT) | KIKUSUI | B0109/02 |
| J1  | 83-30-1190 | BNC CONNECTOR            |         | *2       |
| J2  | 83-30-1190 | BNC CONNECTOR            |         | *2       |
| K1  | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *2       |
| K2  | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *2       |
| K11 | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *2       |
| K12 | 71-07-0370 | RELAY (DC 5V)            | DS1-S   | *2       |

NOTE : \*1. The H3 is a Attenuator unit consisted of case,shield plate,bracket,PC Board, J1,K1,K2,K3 and other component.

\*2. The H4 is a Attenuator unit consisted of case,shield plate,bracket,PC Board, J1,J2,K1,K2,K11,K12 and other component.

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0230

A4 ASSEMBLY

|     |            |                |                |           |
|-----|------------|----------------|----------------|-----------|
| C1  | 54-40-1210 | FXD ELECT      | 22MF           | 50WV      |
| C2  | 54-40-1210 | FXD ELECT      | 22MF           | 50WV      |
| C3  | 54-40-1210 | FXD ELECT      | 22MF           | 50WV      |
| C4  | 54-40-1210 | FXD ELECT      | 22MF           | 50WV      |
| C5  | 54-40-1210 | FXD ELECT      | 22MF           | 50WV      |
| C6  | 54-40-1210 | FXD ELECT      | 22MF           | 50WV      |
| C7  | 56-48-1000 | FXD CER        | EMI FILTER     |           |
| C8  | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C9  | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C10 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |
| C11 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |
| C12 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C13 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |
| C14 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |
| C15 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C16 | 52-06-2184 | FXD CER        | 47PF 10%       | 50V TYPE1 |
| C17 | 52-06-2184 | FXD CER        | 47PF 10%       | 50V TYPE1 |
| C18 | 52-06-2184 | FXD CER        | 47PF 10%       | 50V TYPE1 |
| C19 | 52-06-2184 | FXD CER        | 47PF 10%       | 50V TYPE1 |
| C20 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C21 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C22 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C23 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |
| C24 | 55-37-2050 | FXD TANT ELECT | 1UF            | 35V       |
| C25 | 55-37-2050 | FXD TANT ELECT | 1UF            | 35V       |
| C26 | 55-37-2050 | FXD TANT ELECT | 1UF            | 35V       |
| C27 | 54-40-1200 | FXD ELECT      | 10MF           | 50WV      |
| C28 | 54-40-1200 | FXD ELECT      | 10MF           | 50WV      |
| C31 | 52-06-2225 | FXD CER        | 100PF 10%      | 50V TYPE1 |
| C32 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C33 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C34 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |
| C35 | 50-45-3530 | FXD PLSTC FILM | 0.1MF 5%       | 63WV      |
| C36 | 52-06-2245 | FXD CER        | 150PF 10%      | 50V TYPE1 |
| C38 | 52-06-2245 | FXD CER        | 150PF 10%      | 50V TYPE1 |
| C40 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C41 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C42 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C43 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C44 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C45 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C46 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C47 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C48 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |
| C49 | 52-01-2345 | FXD CER        | 1000PF 10%     | 50V TYPE2 |
| C50 | 52-01-2345 | FXD CER        | 1000PF 10%     | 50V TYPE2 |

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| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION      | 97-11-0230        |     |
|-------------------------|----------------------|------------------|-------------------|-----|
| C51                     | 52-01-2345           | FXD CER 1000PF   | 10% 50V TYPE2     |     |
| C52                     | 52-01-2345           | FXD CER 1000PF   | 10% 50V TYPE2     |     |
| C53                     | 52-01-2345           | FXD CER 1000PF   | 10% 50V TYPE2     |     |
| C54                     | 52-01-2345           | FXD CER 1000PF   | 10% 50V TYPE2     |     |
| C55                     | 50-65-3570           | FXD PLSTC FILM   | 0.01MF 5% 100WV   | AWS |
| C56                     | 50-65-0540           | FXD M PLSTC FILM | 1UF 5% 100WV      |     |
| C57                     | 50-65-3570           | FXD PLSTC FILM   | 0.01MF 5% 100WV   | AWS |
| C58                     | 50-65-0540           | FXD M PLSTC FILM | 1UF 5% 100WV      |     |
| C59                     | 52-06-2184           | FXD CER 47PF     | 10% 50V TYPE1     |     |
| C60                     | 52-06-2184           | FXD CER 47PF     | 10% 50V TYPE1     |     |
| C61                     | 52-06-2184           | FXD CER 47PF     | 10% 50V TYPE1     |     |
| C62                     | 52-06-2184           | FXD CER 47PF     | 10% 50V TYPE1     |     |
| C65                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C67                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C68                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C69                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C70                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C71                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C72                     | 55-37-2050           | FXD TANT ELECT   | 1UF 35V           |     |
| C73                     | 55-37-2050           | FXD TANT ELECT   | 1UF 35V           |     |
| C74                     | 55-37-2050           | FXD TANT ELECT   | 1UF 35V           |     |
| C75                     | 55-37-2050           | FXD TANT ELECT   | 1UF 35V           |     |
| C76                     | 50-67-0030           | FXD PLSTC FILM   | 0.01MF 10% 100WV  |     |
| C77                     | 54-30-1970           | FXD ELECT        | 100MF 25WV        |     |
| C78                     | 50-67-0050           | FXD PLSTC FILM   | 0.047MF 10% 100WV |     |
| C79                     | 52-06-2204           | FXD CER 68P      | 10% 50V TYPE1     |     |
| C80                     | 54-40-1200           | FXD ELECT        | 10MF 50WV         |     |
| C81                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C83                     | 54-40-1210           | FXD ELECT        | 22MF 50WV         |     |
| C84                     | 54-30-1970           | FXD ELECT        | 100MF 25WV        |     |
| C85                     | 54-30-1970           | FXD ELECT        | 100MF 25WV        |     |
| C86                     | 52-01-2385           | FXD CER 2200PF   | 10% 50V TYPE2     |     |
| C88                     | 52-01-2265           | FXD CER 220PF    | 10% 50V TYPE2     |     |
| C89                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C90                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C91                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C92                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C93                     | 54-40-1210           | FXD ELECT        | 22MF 50WV         |     |
| C94                     | 54-30-1970           | FXD ELECT        | 100MF 25WV        |     |
| C95                     | 54-30-1970           | FXD ELECT        | 100MF 25WV        |     |
| C96                     | 54-30-1970           | FXD ELECT        | 100MF 25WV        |     |
| C97                     | 54-30-1970           | FXD ELECT        | 100MF 25WV        |     |
| C98                     | 56-48-1000           | FXD CER          | EMI FILTER        |     |
| C99                     | 56-48-1000           | FXD CER          | EMI FILTER        |     |
| C100                    | 56-48-1000           | FXD CER          | EMI FILTER        |     |
| C101                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C102                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C103                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C104                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C105                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C106                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C107                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C108                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C109                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION         |          |         |            | 97-11-0230 |
|-------------------------|----------------------|---------------------|----------|---------|------------|------------|
| C110                    | 52-05-2468           | FXD CER             | 0.01UF   | +80-20% | 50V TYPE2  |            |
| C111                    | 52-05-2468           | FXD CER             | 0.01UF   | +80-20% | 50V TYPE2  |            |
| C112                    | 52-05-2468           | FXD CER             | 0.01UF   | +80-20% | 50V TYPE2  |            |
| C113                    | 52-05-2468           | FXD CER             | 0.01UF   | +80-20% | 50V TYPE2  |            |
| C114                    | 52-05-2468           | FXD CER             | 0.01UF   | +80-20% | 50V TYPE2  |            |
| C115                    | 52-05-2468           | FXD CER             | 0.01UF   | +80-20% | 50V TYPE2  |            |
| C116                    | 52-01-2345           | FXD CER             | 1000PF   | 10%     | 50V TYPE2  |            |
| C117                    | 52-06-2225           | FXD CER             | 100PF    | 10%     | 50V TYPE1  |            |
| C118                    | 55-37-2050           | FXD TANT ELECT      | 1UF      |         | 35V        |            |
| C119                    | 52-06-2102           | FXD CER             | 10P      | 10%     | 50V TYPE1  |            |
| C120                    | 52-06-2165           | FXD CER             | 33PF     | 10%     | 500V TYPE1 |            |
| C121                    | 55-37-2100           | FXD TANT ELECT      | 10UF     |         | 35V        |            |
| C122                    | 52-01-2305           | FXD CER             | 470PF    | 10%     | 50V TYPE2  |            |
| C124                    | 52-05-2468           | FXD CER             | 0.01UF   | +80-20% | 50V TYPE2  |            |
| C125                    | 52-06-3125           | FXD CER             | 15PF     | 10%     | 500V TYPE1 |            |
| C126                    | 52-06-3125           | FXD CER             | 15PF     | 10%     | 500V TYPE1 |            |
| C132                    | 52-06-2102           | FXD CER             | 10P      | 10%     | 50V TYPE1  |            |
| C134                    | 52-01-2345           | FXD CER             | 1000PF   | 10%     | 50V TYPE2  |            |
| C135                    | 52-01-2345           | FXD CER             | 1000PF   | 10%     | 50V TYPE2  |            |
| CR1                     | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR2                     | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR3                     | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR4                     | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR5                     | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR6                     | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR7                     | 32-30-0860           | DIODE VR=30V        | IO=30MA  |         | HITACHI    | 1SS86      |
| CR8                     | 32-30-0860           | DIODE VR=30V        | IO=30MA  |         | HITACHI    | 1SS86      |
| CR9                     | 32-92-0100           | ZENER VZ=10.1-10.6V | P=0.4W   |         | NEC        | RD10JB3    |
| CR10                    | 32-92-0056           | ZENER VZ=5.5 - 5.8V | P=0.4W   |         | NEC        | RD5.6JB2   |
| CR11                    | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR12                    | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR13                    | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR14                    | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CR15                    | 32-30-1200           | DIODE VR=60V        | IO=1A    |         | HITACHI    | 1SS120     |
| CV1                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| CV2                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| CV3                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| CV4                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| CV5                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| CV6                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| CV7                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| CV8                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| CV9                     | 57-10-1242           | VAR CER             | 5.6-20PF |         | ALPS       | CTZ31E     |
| Q1                      | 30-31-9071           | TR SI NPN           |          |         | HITACHI    | 2SC1907    |
| Q2                      | 30-31-9071           | TR SI NPN           |          |         | HITACHI    | 2SC1907    |
| Q3                      | 30-31-9071           | TR SI NPN           |          |         | HITACHI    | 2SC1907    |
| Q4                      | 30-31-9071           | TR SI NPN           |          |         | HITACHI    | 2SC1907    |
| Q5                      | 30-11-0051           | TR SI PNP           |          |         | NEC        | 2SA1005-L  |
| Q6                      | 30-31-9071           | TR SI NPN           |          |         | HITACHI    | 2SC1907    |
| Q7                      | 30-32-1201           | TR SI NPN           |          |         | TOSHIBA    | 2SC2120-Y  |
| Q8                      | 30-32-1201           | TR SI NPN           |          |         | TOSHIBA    | 2SC2120-Y  |



REFERENCE  
DESIGNATOR

KIKUSUI  
PARTS NO.

DESCRIPTION

97-11-0230

|     |            |           |         |           |
|-----|------------|-----------|---------|-----------|
| Q9  | 30-30-9451 | TR SI NPN | NEC     | 2SC945-Q  |
| Q10 | 30-30-9451 | TR SI NPN | NEC     | 2SC945-Q  |
| Q11 | 30-10-8441 | TR SI PNP | HITACHI | 2SA844-D  |
| Q12 | 30-30-9451 | TR SI NPN | NEC     | 2SC945-Q  |
| Q13 | 30-31-9071 | TR SI NPN | HITACHI | 2SC1907   |
| Q14 | 30-31-9071 | TR SI NPN | HITACHI | 2SC1907   |
| Q15 | 30-32-1201 | TR SI NPN | TOSHIBA | 2SC2120-Y |
| Q16 | 30-32-1201 | TR SI NPN | TOSHIBA | 2SC2120-Y |
| Q17 | 30-30-9451 | TR SI NPN | NEC     | 2SC945-Q  |
| Q18 | 30-30-9451 | TR SI NPN | NEC     | 2SC945-Q  |
| Q19 | 30-11-0051 | TR SI PNP | NEC     | 2SA1005-L |

|     |            |            |      |        |      |         |
|-----|------------|------------|------|--------|------|---------|
| R1  | 40-16-2101 | FXD C FILM | 1K   | OHM 5% | 1/6W | RD1/6FS |
| R2  | 40-16-2101 | FXD C FILM | 1K   | OHM 5% | 1/6W | RD1/6FS |
| R3  | 42-80-0101 | FXD M FILM | 10   | OHM 1% | 1/6W | RN1/6FS |
| R4  | 42-80-1391 | FXD M FILM | 390  | OHM 1% | 1/6W | RN1/6FS |
| R5  | 42-80-3181 | FXD M FILM | 18K  | OHM 1% | 1/6W | RN1/6FS |
| R6  | 42-80-2181 | FXD M FILM | 1.8K | OHM 1% | 1/6W | RN1/6FS |
| R7  | 40-16-3221 | FXD C FILM | 22K  | OHM 5% | 1/6W | RD1/6FS |
| R8  | 40-16-3221 | FXD C FILM | 22K  | OHM 5% | 1/6W | RD1/6FS |
| R9  | 40-16-1561 | FXD C FILM | 560  | OHM 5% | 1/6W | RD1/6FS |
| R10 | 40-16-3101 | FXD C FILM | 10K  | OHM 5% | 1/6W | RD1/6FS |
| R11 | 40-16-1101 | FXD C FILM | 100  | OHM 5% | 1/6W | RD1/6FS |
| R12 | 40-16-3101 | FXD C FILM | 10K  | OHM 5% | 1/6W | RD1/6FS |
| R13 | 40-16-1101 | FXD C FILM | 100  | OHM 5% | 1/6W | RD1/6FS |
| R14 | 42-80-1181 | FXD M FILM | 180  | OHM 1% | 1/6W | RN1/6FS |
| R15 | 42-80-1181 | FXD M FILM | 180  | OHM 1% | 1/6W | RN1/6FS |
| R16 | 40-16-1561 | FXD C FILM | 560  | OHM 5% | 1/6W | RD1/6FS |
| R17 | 40-16-1221 | FXD C FILM | 220  | OHM 5% | 1/6W | RD1/6FS |
| R18 | 42-80-1181 | FXD M FILM | 180  | OHM 1% | 1/6W | RN1/6FS |
| R19 | 42-80-1181 | FXD M FILM | 180  | OHM 1% | 1/6W | RN1/6FS |
| R20 | 40-16-1561 | FXD C FILM | 560  | OHM 5% | 1/6W | RD1/6FS |
| R21 | 40-16-1221 | FXD C FILM | 220  | OHM 5% | 1/6W | RD1/6FS |
| R22 | 40-16-0391 | FXD C FILM | 39   | OHM 5% | 1/6W | RD1/6FS |
| R23 | 42-80-0821 | FXD M FILM | 82   | OHM 1% | 1/6W | RN1/6FS |
| R24 | 40-16-0391 | FXD C FILM | 39   | OHM 5% | 1/6W | RD1/6FS |
| R25 | 42-80-0821 | FXD M FILM | 82   | OHM 1% | 1/6W | RN1/6FS |
| R26 | 40-16-3101 | FXD C FILM | 10K  | OHM 5% | 1/6W | RD1/6FS |
| R27 | 40-16-2471 | FXD C FILM | 4.7K | OHM 5% | 1/6W | RD1/6FS |
| R28 | 40-16-3101 | FXD C FILM | 10K  | OHM 5% | 1/6W | RD1/6FS |
| R30 | 40-16-2561 | FXD C FILM | 5.6K | OHM 5% | 1/6W | RD1/6FS |
| R31 | 40-16-2561 | FXD C FILM | 5.6K | OHM 5% | 1/6W | RD1/6FS |
| R32 | 40-16-2471 | FXD C FILM | 4.7K | OHM 5% | 1/6W | RD1/6FS |
| R33 | 40-16-2471 | FXD C FILM | 4.7K | OHM 5% | 1/6W | RD1/6FS |
| R34 | 40-16-2821 | FXD C FILM | 8.2K | OHM 5% | 1/6W | RD1/6FS |
| R35 | 40-16-2821 | FXD C FILM | 8.2K | OHM 5% | 1/6W | RD1/6FS |
| R36 | 40-16-2271 | FXD C FILM | 2.7K | OHM 5% | 1/6W | RD1/6FS |
| R37 | 40-16-2561 | FXD C FILM | 5.6K | OHM 5% | 1/6W | RD1/6FS |
| R38 | 40-16-1821 | FXD C FILM | 820  | OHM 5% | 1/6W | RD1/6FS |
| R39 | 40-16-3101 | FXD C FILM | 10K  | OHM 5% | 1/6W | RD1/6FS |
| R40 | 40-16-2331 | FXD C FILM | 3.3K | OHM 5% | 1/6W | RD1/6FS |
| R41 | 40-16-1221 | FXD C FILM | 220  | OHM 5% | 1/6W | RD1/6FS |
| R42 | 40-16-1221 | FXD C FILM | 220  | OHM 5% | 1/6W | RD1/6FS |
| R43 | 40-16-1101 | FXD C FILM | 100  | OHM 5% | 1/6W | RD1/6FS |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION     | 97-11-0230  |              |
|-------------------------|----------------------|-----------------|-------------|--------------|
| R44                     | 40-16-3331           | FXD C FILM 33K  | OHM 5% 1/6W | RD1/6FS      |
| R45                     | 42-80-2221           | FXD M FILM 2.2K | OHM 1% 1/6W | RN1/6FS      |
| R46                     | 42-80-2391           | FXD M FILM 3.9K | OHM 1% 1/6W | RN1/6FS      |
| R47                     | 40-16-0001           | FXD C FILM 0    | OHM 5% 1/6W | RD1/6FS      |
| R48                     | 38-00-0080           | THERMISTOR 2500 | OHM         | TOSHIBA D33A |
| R49                     | 40-16-3221           | FXD C FILM 22K  | OHM 5% 1/6W | RD1/6FS      |
| R50                     | 40-16-3101           | FXD C FILM 10K  | OHM 5% 1/6W | RD1/6FS      |
| R51                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R53                     | 42-80-0911           | FXD M FILM 91   | OHM 1% 1/6W | RN1/6FS      |
| R54                     | 42-80-0911           | FXD M FILM 91   | OHM 1% 1/6W | RN1/6FS      |
| R55                     | 40-16-3221           | FXD C FILM 22K  | OHM 5% 1/6W | RD1/6FS      |
| R56                     | 40-16-3221           | FXD C FILM 22K  | OHM 5% 1/6W | RD1/6FS      |
| R57                     | 40-16-5101           | FXD C FILM 1M   | OHM 5% 1/6W | RD1/6FS      |
| R58                     | 40-16-5101           | FXD C FILM 1M   | OHM 5% 1/6W | RD1/6FS      |
| R59                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R60                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R61                     | 40-16-2331           | FXD C FILM 3.3K | OHM 5% 1/6W | RD1/6FS      |
| R62                     | 40-16-2681           | FXD C FILM 6.8K | OHM 5% 1/6W | RD1/6FS      |
| R63                     | 40-16-2681           | FXD C FILM 6.8K | OHM 5% 1/6W | RD1/6FS      |
| R64                     | 40-16-2331           | FXD C FILM 3.3K | OHM 5% 1/6W | RD1/6FS      |
| R65                     | 40-16-3101           | FXD C FILM 10K  | OHM 5% 1/6W | RD1/6FS      |
| R66                     | 40-16-2821           | FXD C FILM 8.2K | OHM 5% 1/6W | RD1/6FS      |
| R68                     | 40-16-2271           | FXD C FILM 2.7K | OHM 5% 1/6W | RD1/6FS      |
| R70                     | 40-16-2331           | FXD C FILM 3.3K | OHM 5% 1/6W | RD1/6FS      |
| R71                     | 40-16-1471           | FXD C FILM 470  | OHM 5% 1/6W | RD1/6FS      |
| R72                     | 40-16-1681           | FXD C FILM 680  | OHM 5% 1/6W | RD1/6FS      |
| R73                     | 42-80-2391           | FXD M FILM 3.9K | OHM 1% 1/6W | RN1/6FS      |
| R74                     | 42-80-2331           | FXD M FILM 3.3K | OHM 1% 1/6W | RN1/6FS      |
| R75                     | 40-16-3271           | FXD C FILM 27K  | OHM 5% 1/6W | RD1/6FS      |
| R76                     | 40-16-3101           | FXD C FILM 10K  | OHM 5% 1/6W | RD1/6FS      |
| R77                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R78                     | 40-16-1151           | FXD C FILM 150  | OHM 5% 1/6W | RD1/6FS      |
| R79                     | 40-16-2151           | FXD C FILM 1.5K | OHM 5% 1/6W | RD1/6FS      |
| R80                     | 40-16-1561           | FXD C FILM 560  | OHM 5% 1/6W | RD1/6FS      |
| R81                     | 40-16-2271           | FXD C FILM 2.7K | OHM 5% 1/6W | RD1/6FS      |
| R82                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R83                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R84                     | 40-16-2121           | FXD C FILM 1.2K | OHM 5% 1/6W | RD1/6FS      |
| R85                     | 40-16-1471           | FXD C FILM 470  | OHM 5% 1/6W | RD1/6FS      |
| R86                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R87                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R88                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R89                     | 40-16-1271           | FXD C FILM 270  | OHM 5% 1/6W | RD1/6FS      |
| R90                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R91                     | 42-80-2221           | FXD M FILM 2.2K | OHM 1% 1/6W | RN1/6FS      |
| R92                     | 42-80-2681           | FXD M FILM 6.8K | OHM 1% 1/6W | RN1/6FS      |
| R93                     | 40-16-1101           | FXD C FILM 100  | OHM 5% 1/6W | RD1/6FS      |
| R94                     | 40-16-0101           | FXD C FILM 10   | OHM 5% 1/6W | RD1/6FS      |
| R95                     | 42-80-3101           | FXD M FILM 10K  | OHM 1% 1/6W | RN1/6FS      |
| R96                     | 42-80-3101           | FXD M FILM 10K  | OHM 1% 1/6W | RN1/6FS      |
| R97                     | 42-80-2131           | FXD M FILM 1.3K | OHM 1% 1/6W | RN1/6FS      |
| R98                     | 42-80-2101           | FXD M FILM 1K   | OHM 1% 1/6W | RN1/6FS      |
| R99                     | 40-16-3101           | FXD C FILM 10K  | OHM 5% 1/6W | RD1/6FS      |
| R100                    | 42-80-2131           | FXD M FILM 1.3K | OHM 1% 1/6W | RN1/6FS      |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION |      | 97-11-0230 |    |        |           |
|-------------------------|----------------------|-------------|------|------------|----|--------|-----------|
| R101                    | 42-80-2101           | FXD M FILM  | 1K   | OHM        | 1% | 1/6W   | RN1/6FS   |
| R102                    | 40-16-3101           | FXD C FILM  | 10K  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R103                    | 42-80-2121           | FXD M FILM  | 1.2K | OHM        | 1% | 1/6W   | RN1/6FS   |
| R104                    | 42-80-2101           | FXD M FILM  | 1K   | OHM        | 1% | 1/6W   | RN1/6FS   |
| R105                    | 40-16-3101           | FXD C FILM  | 10K  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R106                    | 42-80-2151           | FXD M FILM  | 1.5K | OHM        | 1% | 1/6W   | RN1/6FS   |
| R107                    | 42-80-2101           | FXD M FILM  | 1K   | OHM        | 1% | 1/6W   | RN1/6FS   |
| R108                    | 40-16-2101           | FXD C FILM  | 1K   | OHM        | 5% | 1/6W   | RD1/6FS   |
| R109                    | 40-16-1681           | FXD C FILM  | 680  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R110                    | 40-16-2121           | FXD C FILM  | 1.2K | OHM        | 5% | 1/6W   | RD1/6FS   |
| R111                    | 40-16-2121           | FXD C FILM  | 1.2K | OHM        | 5% | 1/6W   | RD1/6FS   |
| R112                    | 40-16-1331           | FXD C FILM  | 330  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R113                    | 40-16-3221           | FXD C FILM  | 22K  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R114                    | 40-16-1821           | FXD C FILM  | 820  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R116                    | 40-16-0561           | FXD C FILM  | 56   | OHM        | 5% | 1/6W   | RD1/6FS   |
| R117                    | 42-80-1391           | FXD M FILM  | 390  | OHM        | 1% | 1/6W   | RN1/6FS   |
| R118                    | 42-80-1391           | FXD M FILM  | 390  | OHM        | 1% | 1/6W   | RN1/6FS   |
| R119                    | 42-80-2101           | FXD M FILM  | 1K   | OHM        | 1% | 1/6W   | RN1/6FS   |
| R120                    | 42-80-3101           | FXD M FILM  | 10K  | OHM        | 1% | 1/6W   | RN1/6FS   |
| R121                    | 42-80-3101           | FXD M FILM  | 10K  | OHM        | 1% | 1/6W   | RN1/6FS   |
| R122                    | 42-80-2391           | FXD M FILM  | 3.9K | OHM        | 1% | 1/6W   | RN1/6FS   |
| R123                    | 42-80-2391           | FXD M FILM  | 3.9K | OHM        | 1% | 1/6W   | RN1/6FS   |
| R124                    | 40-16-2331           | FXD C FILM  | 3.3K | OHM        | 5% | 1/6W   | RD1/6FS   |
| R125                    | 40-16-2331           | FXD C FILM  | 3.3K | OHM        | 5% | 1/6W   | RD1/6FS   |
| R126                    | 40-16-1151           | FXD C FILM  | 150  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R127                    | 40-16-1151           | FXD C FILM  | 150  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R128                    | 40-16-3101           | FXD C FILM  | 10K  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R129                    | 40-16-2151           | FXD C FILM  | 1.5K | OHM        | 5% | 1/6W   | RD1/6FS   |
| R130                    | 40-16-2151           | FXD C FILM  | 1.5K | OHM        | 5% | 1/6W   | RD1/6FS   |
| R131                    | 40-16-1681           | FXD C FILM  | 680  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R132                    | 40-16-1221           | FXD C FILM  | 220  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R133                    | 40-16-0331           | FXD C FILM  | 33   | OHM        | 5% | 1/6W   | RD1/6FS   |
| R134                    | 40-16-2181           | FXD C FILM  | 1.8K | OHM        | 5% | 1/6W   | RD1/6FS   |
| R135                    | 40-16-1561           | FXD C FILM  | 560  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R136                    | 40-16-1221           | FXD C FILM  | 220  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R139                    | 40-16-3101           | FXD C FILM  | 10K  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R140                    | 40-16-3101           | FXD C FILM  | 10K  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R141                    | 40-16-3101           | FXD C FILM  | 10K  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R146                    | 40-16-1561           | FXD C FILM  | 560  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R147                    | 40-16-1151           | FXD C FILM  | 150  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R148                    | 40-16-1151           | FXD C FILM  | 150  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R149                    | 40-16-1151           | FXD C FILM  | 150  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R150                    | 40-16-1151           | FXD C FILM  | 150  | OHM        | 5% | 1/6W   | RD1/6FS   |
| R152                    | 41-10-2221           | FXD M GLAZE | 2.2K | OHM        | 5% | 1/8W   | CHIP RESI |
| R153                    | 41-10-2221           | FXD M GLAZE | 2.2K | OHM        | 5% | 1/8W   | CHIP RESI |
| RV1                     | 48-37-1500           | VAR M GLAZE | 500  | OHM        | B  | TEITSU | VM5CKPV   |
| RV2                     | 48-37-1200           | VAR M GLAZE | 200  | OHM        | B  | TEITSU | VM5CKPV   |
| RV3                     | 48-37-1200           | VAR M GLAZE | 200  | OHM        | B  | TEITSU | VM5CKPV   |
| RV4                     | 48-37-1200           | VAR M GLAZE | 200  | OHM        | B  | TEITSU | VM5CKPV   |
| RV5                     | 48-37-1200           | VAR M GLAZE | 200  | OHM        | B  | TEITSU | VM5CKPV   |
| RV6                     | 48-37-2100           | VAR M GLAZE | 1K   | OHM        | B  | TEITSU | VM5CKPV   |
| RV7                     | 48-37-1200           | VAR M GLAZE | 200  | OHM        | B  | TEITSU | VM5CKPV   |
| RV8                     | 48-37-2100           | VAR M GLAZE | 1K   | OHM        | B  | TEITSU | VM5CKPV   |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                  | 97-11-0230 |            |           |
|-------------------------|----------------------|------------------------------|------------|------------|-----------|
| RV9                     | 48-37-1200           | VAR M GLAZE 200              | OHM B      | TEITSU     | VM5CKPV   |
| RV10                    | 48-37-2100           | VAR M GLAZE 1K               | OHM B      | TEITSU     | VM5CKPV   |
| RV11                    | 48-37-1200           | VAR M GLAZE 200              | OHM B      | TEITSU     | VM5CKPV   |
| RV12                    | 48-37-2100           | VAR M GLAZE 1K               | OHM B      | TEITSU     | VM5CKPV   |
| RV13                    | 48-37-1200           | VAR M GLAZE 200              | OHM B      | TEITSU     | VM5CKPV   |
| RV14                    | 48-37-3200           | VAR M GLAZE 20K              | OHM B      | TEITSU     | VM5CKPV   |
| RV15                    | 48-37-3200           | VAR M GLAZE 20K              | OHM B      | TEITSU     | VM5CKPV   |
| RV16                    | 48-37-3200           | VAR M GLAZE 20K              | OHM B      | TEITSU     | VM5CKPV   |
| RV17                    | 48-37-3200           | VAR M GLAZE 20K              | OHM B      | TEITSU     | VM5CKPV   |
| RV18                    | 48-37-2100           | VAR M GLAZE 1K               | OHM B      | TEITSU     | VM5CKPV   |
| RV19                    | 48-37-1200           | VAR M GLAZE 200              | OHM B      | TEITSU     | VM5CKPV   |
| RV20                    | 48-37-1100           | VAR M GLAZE 100              | OHM B      | TEITSU     | VM5CKPV   |
| RV21                    | 48-37-2100           | VAR M GLAZE 1K               | OHM B      | TEITSU     | VM5CKPV   |
| RV22                    | 48-37-3100           | VAR M FILM 10K               | OHM B      |            | VM5CKPV   |
| RV23                    | 48-37-1200           | VAR M GLAZE 200              | OHM B      | TEITSU     | VM5CKPV   |
| RV24                    | 48-37-2500           | VAR M GLAZE 5K               | OHM B      | TEITSU     | VM5CKPV   |
| RV25                    | 48-37-1100           | VAR M GLAZE 100              | OHM B      | TEITSU     | VM5CKPV   |
| RV26                    | 48-37-1100           | VAR M GLAZE 100              | OHM B      | TEITSU     | VM5CKPV   |
| RV27                    | 48-37-2100           | VAR M GLAZE 1K               | OHM B      | TEITSU     | VM5CKPV   |
| RV28                    | 48-37-2100           | VAR M GLAZE 1K               | OHM B      | TEITSU     | VM5CKPV   |
| RV29                    | 48-37-1500           | VAR M GLAZE 500              | OHM B      | TEITSU     | VM5CKPV   |
| RV30                    | 48-37-2100           | VAR M GLAZE 1K               | OHM B      | TEITSU     | VM5CKPV   |
| RV31                    | 48-37-2200           | VAR M GLAZE 2K               | OHM B      | TEITSU     | VM5CKPV   |
| RV32                    | 48-37-3200           | VAR M GLAZE 20K              | OHM B      | TEITSU     | VM5CKPV   |
| RV33                    | 48-37-2100           | VAR M GLAZE 1K               | OHM B      | TEITSU     | VM5CKPV   |
| RV34                    | 48-37-1100           | VAR M GLAZE 100              | OHM B      | TEITSU     | VM5CKPV   |
| U1                      | 35-53-0864           | QUAD 2-INPUT EXCLUSIVE-OR    |            | TOSHIBA    | TC74HC86P |
| U2                      | 34-00-0215           | J-FET INPUT OPE-AMP          |            | TEXAS INS. | TL081CP   |
| U3                      | 36-00-1050           | HIC (H5 2ND ATT)             |            | KIKUSUI    | B0209/12  |
| U4                      | 36-00-1050           | HIC (H5 2ND ATT)             |            | KIKUSUI    | B0209/12  |
| U5                      | 35-56-0940           | 8-STAGE SHIHT REGISTER       |            | TOSHIBA    | TC4094BP  |
| U6                      | 35-56-0940           | 8-STAGE SHIHT REGISTER       |            | TOSHIBA    | TC4094BP  |
| U7                      | 35-56-0940           | 8-STAGE SHIHT REGISTER       |            | TOSHIBA    | TC4094BP  |
| U8                      | 35-56-0940           | 8-STAGE SHIHT REGISTER       |            | TOSHIBA    | TC4094BP  |
| U9                      | 35-56-0940           | 8-STAGE SHIHT REGISTER       |            | TOSHIBA    | TC4094BP  |
| U10                     | 35-70-0746           | DUAL D F-F EDGE TRIGGER      |            | TOSHIBA    | TC74HC74P |
| U11                     | 36-00-1060           | HIC (H6 1ST AMP)             |            | KIKUSUI    | B0309/9   |
| U12                     | 36-00-1060           | HIC (H6 1ST AMP)             |            | KIKUSUI    | B0309/9   |
| U13                     | 36-00-1070           | HIC (H7 2ND AMP)             |            | KIKUSUI    | B0409/10  |
| U14                     | 36-00-1070           | HIC (H7 2ND AMP)             |            | KIKUSUI    | B0409/10  |
| U15                     | 36-00-1073           | HIC (H7 2ND AMP CH3/CH4)     |            | KIKUSUI    | B0439/10  |
| U16                     | 36-00-1073           | HIC (H7 2ND AMP CH3/CH4)     |            | KIKUSUI    | B0439/10  |
| U17                     | 36-00-1140           | HIC (H14 ANALOG MPX SP)      |            | KIKUSUI    | B1109/9   |
| U18                     | 36-00-1140           | HIC (H14 ANALOG MPX SP)      |            | KIKUSUI    | B1109/9   |
| U19                     | 36-00-1190           | HIC (H19 SIGNAL OUTPUT AMP)  |            | KIKUSUI    | B1609/12  |
| U20                     | 36-00-1080           | HIC (H8 VERT MODE SWITCH)    |            | KIKUSUI    | B0509/4   |
| U21                     | 36-00-1420           | HIC (H42 DVM TRUE RMS CONV.) |            | KIKUSUI    | B3809/6   |
| U22                     | 36-00-1430           | HIC (H43 DVM PEAK DETECTOR)  |            | KIKUSUI    | B3909/6   |
| U23                     | 34-00-0210           | FET OPE-AMP                  |            | TEXAS INS. | TL084CN   |
| U24                     | 34-69-0030           | TRIPLE 2-CHANNEL MULTIPLEXER |            | TOSHIBA    | TC4053BP  |
| U25                     | 36-00-1090           | HIC (H9 DELAY LINE DRIVER)   |            | KIKUSUI    | B0609/6   |
| U26                     | 36-00-1110           | HIC (H11 ST SIGNAL BUFFER)   |            | KIKUSUI    | B0809/9   |
| U27                     | 36-00-1210           | HIC (H21 TRIG SOUCE SWITCHI) |            | KIKUSUI    | B1709/6   |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                    | 97-11-0230 |            |
|-------------------------|----------------------|--------------------------------|------------|------------|
| U28                     | 36-00-1220           | HIC (H22 TRIG COUPLE SWITCHI)  | KIKUSUI    | B1809/12   |
| U29                     | 36-00-1220           | HIC (H22 TRIG COUPLE SWITCHI)  | KIKUSUI    | B1809/12   |
| U30                     | 36-00-1230           | HIC (H23 TRIG LEVEL COMP.)     | KIKUSUI    | B1909/9    |
| U31                     | 36-00-1230           | HIC (H23 TRIG LEVEL COMP.)     | KIKUSUI    | B1909/9    |
| U32                     | 36-00-1240           | HIC (H24 TV SYNC SEPRATOR)     | KIKUSUI    | B2009/12   |
| U33                     | 35-53-1584           | QUAD 2-TO-1 DATA SELECTOR(INV) | TOSHIBA    | TC74HC158P |
| U34                     | 35-53-1584           | QUAD 2-TO-1 DATA SELECTOR(INV) | TOSHIBA    | TC74HC158P |
| U35                     | 35-56-0940           | 8-STAGE SHIHT REGISTER         | TOSHIBA    | TC4094BP   |
| U36                     | 35-56-0940           | 8-STAGE SHIHT REGISTER         | TOSHIBA    | TC4094BP   |
| U37                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA    | TC74HC4094 |
| U38                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA    | TC74HC4094 |
| U39                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA    | TC74HC4094 |
| U40                     | 35-56-0940           | 8-STAGE SHIHT REGISTER         | TOSHIBA    | TC4094BP   |
| U41                     | 35-56-0940           | 8-STAGE SHIHT REGISTER         | TOSHIBA    | TC4094BP   |
| U42                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA    | TC74HC4094 |
| U43                     | 36-00-1270           | HIC (H27 SWEEP GENERATOR)      | KIKUSUI    | B2309/6    |
| U44                     | 36-00-1270           | HIC (H27 SWEEP GENERATOR)      | KIKUSUI    | B2309/6    |
| U45                     | 34-90-0051           | REGULATOR                      | TEXAS INS. | TL431CLPB  |
| U46                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U47                     | 35-56-0525           | DUAL 4CH ANALOG MPX            | MATSUSITA  | MN74HC4052 |
| U48                     | 36-00-1250           | HIC (H25 SWEEP CONTROLLER)     | KIKUSUI    | B2109/3    |
| U49                     | 35-53-0144           | HEX SHMITT-TRIG INVERTER       | TOSHIBA    | TC74HC14P  |
| U50                     | 34-90-0051           | REGULATOR                      | TEXAS INS. | TL431CLPB  |
| U51                     | 34-00-0090           | OPE-AMP                        | NEC        | UPC741C    |
| U52                     | 36-00-1290           | HIC (H29 SWEEP & COMP.SWITCH)  | KIKUSUI    | B2509/6    |
| U53                     | 35-70-0006           | QUAD 2-INPUT POSI-NAND         | TOSHIBA    | TC74HC00P  |
| U54                     | 35-70-0006           | QUAD 2-INPUT POSI-NAND         | TOSHIBA    | TC74HC00P  |
| U55                     | 36-00-1300           | HIC (H30 HORIZ SW. & DRIVER)   | KIKUSUI    | B2609/6    |
| U56                     | 36-00-1280           | HIC (H28 DELAY TIME COMP.)     | KIKUSUI    | B2409/9    |
| U57                     | 36-00-1340           | HIC (H34 Z-AXIS SW. & DRIVER)  | KIKUSUI    | B3009/6    |
| U58                     | 36-00-1260           | HIC (H26 PRESCALER)            | KIKUSUI    | B2209/12   |
| U59                     | 36-00-1410           | HIC (H41 SEQUENCE CONT.)       | KIKUSUI    | B3709/4    |
| U60                     | 35-56-0280           | BCD TO DECIMAL DECODER         | TOSHIBA    | TC4028BP   |
| U61                     | 35-56-0280           | BCD TO DECIMAL DECODER         | TOSHIBA    | TC4028BP   |
| U62                     | 35-53-1254           | QUAD BUS BUFFER GATES (3-ST)   | TOSHIBA    | TC74HC125P |
| U63                     | 35-56-0940           | 8-STAGE SHIHT REGISTER         | TOSHIBA    | TC4094BP   |
| U64                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA    | TC74HC4094 |
| U65                     | 36-00-1140           | HIC (H14 ANALOG MPX SP)        | KIKUSUI    | B1109/9    |
| U66                     | 36-00-1140           | HIC (H14 ANALOG MPX SP)        | KIKUSUI    | B1109/9    |
| U67                     | 35-70-0046           | HEX INVERTERS                  | TOSHIBA    | TC74HC04P  |

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0030

A5 ASSEMBLY

|     |            |                     |             |            |           |
|-----|------------|---------------------|-------------|------------|-----------|
| C3  | 52-06-2165 | FXD CER 33PF        | 10% 500V    | TYPE1      |           |
| C4  | 52-06-2215 | FXD CER 82PF        | 10% 500V    | TYPE1      |           |
| C5  | 50-67-0040 | FXD PLSTC FILM      | 0.022MF     | 10% 100WV  |           |
| C6  | 50-67-0000 | FXD PLSTC FILM      | 0.001MF     | 10% 100WV  |           |
| C8  | 52-06-2225 | FXD CER 100PF       | 10% 50V     | TYPE1      |           |
| C9  | 52-06-2225 | FXD CER 100PF       | 10% 50V     | TYPE1      |           |
| C11 | 52-06-2184 | FXD CER 47PF        | 10% 50V     | TYPE1      |           |
| C12 | 52-06-2184 | FXD CER 47PF        | 10% 50V     | TYPE1      |           |
| C13 | 54-40-1200 | FXD ELECT 10MF      | 50WV        |            |           |
| C14 | 54-40-1200 | FXD ELECT 10MF      | 50WV        |            |           |
| C15 | 52-03-3469 | FXD CER 0.01UF      | +100-0%     | 500V TYPE2 |           |
| C16 | 52-03-3469 | FXD CER 0.01UF      | +100-0%     | 500V TYPE2 |           |
| C21 | 54-40-1200 | FXD ELECT 10MF      | 50WV        |            |           |
| C22 | 54-70-1080 | FXD ELECT 2.2MF     | 250WV       |            |           |
| C23 | 52-03-3469 | FXD CER 0.01UF      | +100-0%     | 500V TYPE2 |           |
| C24 | 50-77-3500 | FXD PLSTC FILM      | 0.047MF     | 20% 250WV  |           |
| C25 | 54-30-1960 | FXD ELECT 47MF      | 25WV        |            |           |
| C26 | 52-03-3469 | FXD CER 0.01UF      | +100-0%     | 500V TYPE2 |           |
| C27 | 50-77-3500 | FXD PLSTC FILM      | 0.047MF     | 20% 250WV  |           |
| C28 | 54-40-1200 | FXD ELECT 10MF      | 50WV        |            |           |
| C29 | 52-06-2225 | FXD CER 100PF       | 10% 50V     | TYPE1      |           |
| C30 | 52-06-2225 | FXD CER 100PF       | 10% 50V     | TYPE1      |           |
| C33 | 52-06-2184 | FXD CER 47PF        | 10% 50V     | TYPE1      |           |
| C34 | 52-01-2345 | FXD CER 1000PF      | 10% 50V     | TYPE2      |           |
| C35 | 52-06-3102 | FXD CER 10PF        | 10% 500V    | TYPE1      |           |
| C36 | 52-06-2285 | FXD CER 330PF       | 10% 50V     | TYPE1      |           |
| CR1 | 32-30-1200 | DIODE VR=60V        | IO=1A       | HITACHI    | 1SS120    |
| CR2 | 32-30-1200 | DIODE VR=60V        | IO=1A       | HITACHI    | 1SS120    |
| CV1 | 57-10-1203 | VAR CER 5-20PF      |             |            |           |
| CV2 | 57-10-1223 | VAR CER 8-50PF      |             |            |           |
| CV3 | 57-10-1223 | VAR CER 8-50PF      |             |            |           |
| CV5 | 57-10-1223 | VAR CER 8-50PF      |             |            |           |
| L1  | 67-05-0000 | INDUCTOR L-2868     |             |            |           |
| L2  | 67-05-0000 | INDUCTOR L-2868     |             |            |           |
| Q1  | 30-10-8441 | TR SI PNP           |             | HITACHI    | 2SA844-D  |
| Q2  | 30-33-5961 | TR SI NPN (80V 0.3A | W)          |            | 2SC3596-D |
| Q3  | 30-33-5961 | TR SI NPN (80V 0.3A | W)          |            | 2SC3596-D |
| Q4  | 30-31-9071 | TR SI NPN           |             | HITACHI    | 2SC1907   |
| Q5  | 30-31-9071 | TR SI NPN           |             | HITACHI    | 2SC1907   |
| Q6  | 30-31-9071 | TR SI NPN           |             | HITACHI    | 2SC1907   |
| R1  | 42-80-0911 | FXD M FILM 91       | OHM 1% 1/6W |            | RN1/6FS   |
| R2  | 42-80-0911 | FXD M FILM 91       | OHM 1% 1/6W |            | RN1/6FS   |
| R4  | 40-16-1121 | FXD C FILM 120      | OHM 5% 1/6W |            | RD1/6FS   |
| R5  | 40-16-3121 | FXD C FILM 12K      | OHM 5% 1/6W |            | RD1/6FS   |
| R6  | 40-16-2561 | FXD C FILM 5.6K     | OHM 5% 1/6W |            | RD1/6FS   |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                 |      |        | 97-11-0030 |            |         |
|-------------------------|----------------------|-----------------------------|------|--------|------------|------------|---------|
| R7                      | 40-16-2101           | FXD C FILM                  | 1K   | OHM 5% | 1/6W       |            | RD1/6FS |
| R8                      | 42-80-2271           | FXD M FILM                  | 2.7K | OHM 1% | 1/6W       |            | RN1/6FS |
| R9                      | 42-80-2271           | FXD M FILM                  | 2.7K | OHM 1% | 1/6W       |            | RN1/6FS |
| R10                     | 42-80-2681           | FXD M FILM                  | 6.8K | OHM 1% | 1/6W       |            | RN1/6FS |
| R11                     | 42-80-2681           | FXD M FILM                  | 6.8K | OHM 1% | 1/6W       |            | RN1/6FS |
| R12                     | 40-16-1101           | FXD C FILM                  | 100  | OHM 5% | 1/6W       |            | RD1/6FS |
| R13                     | 40-16-0181           | FXD C FILM                  | 18   | OHM 5% | 1/6W       |            | RD1/6FS |
| R14                     | 40-16-0181           | FXD C FILM                  | 18   | OHM 5% | 1/6W       |            | RD1/6FS |
| R15                     | 40-16-0101           | FXD C FILM                  | 10   | OHM 5% | 1/6W       |            | RD1/6FS |
| R16                     | 40-16-0101           | FXD C FILM                  | 10   | OHM 5% | 1/6W       |            | RD1/6FS |
| R21                     | 40-16-2271           | FXD C FILM                  | 2.7K | OHM 5% | 1/6W       |            | RD1/6FS |
| R22                     | 40-16-3101           | FXD C FILM                  | 10K  | OHM 5% | 1/6W       |            | RD1/6FS |
| R23                     | 40-16-1391           | FXD C FILM                  | 390  | OHM 5% | 1/6W       |            | RD1/6FS |
| R24                     | 40-16-0331           | FXD C FILM                  | 33   | OHM 5% | 1/6W       |            | RD1/6FS |
| R25                     | 40-16-0331           | FXD C FILM                  | 33   | OHM 5% | 1/6W       |            | RD1/6FS |
| R26                     | 38-00-0070           | THERMISTOR                  | 200  | OHM    |            | TOSHIBA    | D22A    |
| R41                     | 44-57-0550           | FXD M FILM                  | 220  | OHM 5% | 3W         |            | ERG3SJ  |
| R42                     | 44-57-0550           | FXD M FILM                  | 220  | OHM 5% | 3W         |            | ERG3SJ  |
| R43                     | 44-57-0550           | FXD M FILM                  | 220  | OHM 5% | 3W         |            | ERG3SJ  |
| R44                     | 44-57-0550           | FXD M FILM                  | 220  | OHM 5% | 3W         |            | ERG3SJ  |
| R45                     | 40-27-0102           | FXD C FILM                  | 10   | OHM 5% | 1/4W       |            | NAS1/4S |
| R51                     | 40-16-1101           | FXD C FILM                  | 100  | OHM 5% | 1/6W       |            | RD1/6FS |
| R52                     | 40-16-2561           | FXD C FILM                  | 5.6K | OHM 5% | 1/6W       |            | RD1/6FS |
| R53                     | 40-16-1331           | FXD C FILM                  | 330  | OHM 5% | 1/6W       |            | RD1/6FS |
| R54                     | 40-16-2561           | FXD C FILM                  | 5.6K | OHM 5% | 1/6W       |            | RD1/6FS |
| R55                     | 40-16-2101           | FXD C FILM                  | 1K   | OHM 5% | 1/6W       |            | RD1/6FS |
| R61                     | 40-16-2101           | FXD C FILM                  | 1K   | OHM 5% | 1/6W       |            | RD1/6FS |
| R62                     | 40-16-2101           | FXD C FILM                  | 1K   | OHM 5% | 1/6W       |            | RD1/6FS |
| R63                     | 40-16-1471           | FXD C FILM                  | 470  | OHM 5% | 1/6W       |            | RD1/6FS |
| R64                     | 40-16-2221           | FXD C FILM                  | 2.2K | OHM 5% | 1/6W       |            | RD1/6FS |
| R65                     | 40-16-0101           | FXD C FILM                  | 10   | OHM 5% | 1/6W       |            | RD1/6FS |
| R67                     | 40-16-4391           | FXD C FILM                  | 390K | OHM 5% | 1/6W       |            | RD1/6FS |
| R68                     | 40-16-2471           | FXD C FILM                  | 4.7K | OHM 5% | 1/6W       |            | RD1/6FS |
| R69                     | 40-16-2101           | FXD C FILM                  | 1K   | OHM 5% | 1/6W       |            | RD1/6FS |
| R70                     | 38-00-0070           | THERMISTOR                  | 200  | OHM    |            | TOSHIBA    | D22A    |
| RV1                     | 48-37-1100           | VAR M GLAZE                 | 100  | OHM B  |            | TEITSU     | VM5CKPV |
| RV2                     | 48-37-1100           | VAR M GLAZE                 | 100  | OHM B  |            | TEITSU     | VM5CKPV |
| RV3                     | 48-37-1200           | VAR M GLAZE                 | 200  | OHM B  |            | TEITSU     | VM5CKPV |
| RV4                     | 48-37-1100           | VAR M GLAZE                 | 100  | OHM B  |            | TEITSU     | VM5CKPV |
| RV5                     | 48-37-2500           | VAR M GLAZE                 | 5K   | OHM B  |            | TEITSU     | VM5CKPV |
| RV6                     | 48-37-2200           | VAR M GLAZE                 | 2K   | OHM B  |            | TEITSU     | VM5CKPV |
| RV7                     | 48-37-1500           | VAR M GLAZE                 | 500  | OHM B  |            | TEITSU     | VM5CKPV |
| RV8                     | 48-37-3200           | VAR M GLAZE                 | 20K  | OHM B  |            | TEITSU     | VM5CKPV |
| U1                      | 34-00-0215           | J-FET INPUT OPE-AMP         |      |        |            | TEXAS INS. | TL081CP |
| U2                      | 36-00-1100           | HIC (H10 VERT FINAL DRIVER) |      |        |            | KIKUSUI    | B0709/6 |
| U3                      | 36-00-1310           | HIC (H31 HORIZ FINAL AMP)   |      |        |            | KIKUSUI    | B2709/6 |



REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0040

A6 ASSEMBLY

|      |            |                     |               |              |          |
|------|------------|---------------------|---------------|--------------|----------|
| C2   | 54-40-1200 | FXD ELECT 10MF      | 50WV          |              |          |
| C4   | 54-40-1200 | FXD ELECT 10MF      | 50WV          |              |          |
| C5   | 52-03-3469 | FXD CER 0.01UF      | +100-0%       | 500V TYPE2   |          |
| C6   | 50-77-3500 | FXD PLSTC FILM      | 0.047MF       | 20% 250WV    |          |
| C7   | 54-30-1970 | FXD ELECT 100MF     | 25WV          |              |          |
| C8   | 52-03-3469 | FXD CER 0.01UF      | +100-0%       | 500V TYPE2   |          |
| C9   | 50-77-3500 | FXD PLSTC FILM      | 0.047MF       | 20% 250WV    |          |
| C10  | 55-37-2050 | FXD TANT ELECT      | 1UF           | 35V          |          |
| C11  | 52-01-2425 | FXD CER 4700PF      | 10%           | 50V TYPE2    |          |
| C12  | 50-67-0040 | FXD PLSTC FILM      | 0.022MF       | 10% 100WV    |          |
| C13  | 50-67-0030 | FXD PLSTC FILM      | 0.01MF        | 10% 100WV    |          |
| C14  | 54-30-1960 | FXD ELECT 47MF      | 25WV          |              |          |
| C15  | 54-30-1970 | FXD ELECT 100MF     | 25WV          |              |          |
| C16  | 52-96-1170 | FXD CER 5PF         | 1KV           |              |          |
| C17  | 52-98-1020 | FXD CER 1000PF      | +80 - -20%    | 3.15KV       |          |
| C18  | 52-98-1020 | FXD CER 1000PF      | +80 - -20%    | 3.15KV       |          |
| C19  | 52-03-3469 | FXD CER 0.01UF      | +100-0%       | 500V TYPE2   |          |
| C20  | 52-98-1000 | FXD CER 4700PF      | +80-20%       | 3.15KV TYPE1 |          |
| C21  | 52-98-1020 | FXD CER 1000PF      | +80 - -20%    | 3.15KV       |          |
| C22  | 52-98-1020 | FXD CER 1000PF      | +80 - -20%    | 3.15KV       |          |
| C23  | 52-96-1170 | FXD CER 5PF         | 1KV           |              |          |
| C24  | 52-98-1020 | FXD CER 1000PF      | +80 - -20%    | 3.15KV       |          |
| C25  | 52-03-3469 | FXD CER 0.01UF      | +100-0%       | 500V TYPE2   |          |
| C26  | 52-98-1000 | FXD CER 4700PF      | +80-20%       | 3.15KV TYPE1 |          |
| C27  | 52-98-1000 | FXD CER 4700PF      | +80-20%       | 3.15KV TYPE1 |          |
| C28  | 52-98-1000 | FXD CER 4700PF      | +80-20%       | 3.15KV TYPE1 |          |
| C29  | 52-98-1000 | FXD CER 4700PF      | +80-20%       | 3.15KV TYPE1 |          |
| C30  | 52-03-3469 | FXD CER 0.01UF      | +100-0%       | 500V TYPE2   |          |
| C31  | 52-03-3469 | FXD CER 0.01UF      | +100-0%       | 500V TYPE2   |          |
| C32  | 52-03-3469 | FXD CER 0.01UF      | +100-0%       | 500V TYPE2   |          |
| C36  | 52-03-3469 | FXD CER 0.01UF      | +100-0%       | 500V TYPE2   |          |
|      |            |                     |               |              |          |
| CR1  | 32-30-1200 | DIODE VR=60V        | IO=1A         | HITACHI      | 1SS120   |
| CR2  | 32-30-1200 | DIODE VR=60V        | IO=1A         | HITACHI      | 1SS120   |
| CR3  | 32-30-1200 | DIODE VR=60V        | IO=1A         | HITACHI      | 1SS120   |
| CR4  | 32-30-1200 | DIODE VR=60V        | IO=1A         | HITACHI      | 1SS120   |
| CR5  | 32-30-1200 | DIODE VR=60V        | IO=1A         | HITACHI      | 1SS120   |
| CR6  | 32-30-1200 | DIODE VR=60V        | IO=1A         | HITACHI      | 1SS120   |
| CR7  | 32-91-2310 | ZENER VZ= 90 - 110V | P=1W          | TOSHIBA      | 1Z100    |
| CR8  | 32-90-3130 | DIODE VR=250V       | IO=0.2A       | MATSUSITA    | MA185    |
| CR9  | 32-90-3130 | DIODE VR=250V       | IO=0.2A       | MATSUSITA    | MA185    |
| CR10 | 32-90-3130 | DIODE VR=250V       | IO=0.2A       | MATSUSITA    | MA185    |
| CR11 | 32-90-1820 | DIODE VR=2KV        | FAST RECOVERY | HITACHI      | ERB26-20 |
| CR12 | 32-90-3130 | DIODE VR=250V       | IO=0.2A       | MATSUSITA    | MA185    |
| CR13 | 32-90-3130 | DIODE VR=250V       | IO=0.2A       | MATSUSITA    | MA185    |
| CR14 | 32-90-3130 | DIODE VR=250V       | IO=0.2A       | MATSUSITA    | MA185    |
| CR15 | 32-90-1820 | DIODE VR=2KV        | FAST RECOVERY | HITACHI      | ERB26-20 |
| CR16 | 32-90-0523 | DIODE VR=600V       | IO=1A         | TOSHIBA      | S5277J   |
| CR17 | 32-90-0523 | DIODE VR=600V       | IO=1A         | TOSHIBA      | S5277J   |
|      |            |                     |               |              |          |
| DS1  | 23-70-0100 | LAMP NEON           |               |              |          |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION               | 97-11-0040  |           |           |
|-------------------------|----------------------|---------------------------|-------------|-----------|-----------|
| DS2                     | 23-70-0100           | LAMP NEON                 |             |           |           |
| DS3                     | 23-70-0100           | LAMP NEON                 |             |           |           |
| L1                      | 67-10-0890           | INDUCTOR 100MH 10%        |             |           |           |
| Q1                      | 30-31-9071           | TR SI NPN                 |             | HITACHI   | 2SC1907   |
| Q2                      | 30-41-4060           | TR SI NPN (60V 3A 25W)    |             | TOSHIBA   | 2SD1406-Y |
| Q3                      | 30-32-7041           | TR SI NPN                 |             | TOSHIBA   | 2SC2704-0 |
| Q4                      | 30-32-7041           | TR SI NPN                 |             | TOSHIBA   | 2SC2704-0 |
| R1                      | 40-16-0471           | FXD C FILM 47             | OHM 5% 1/6W |           | RD1/6FS   |
| R2                      | 40-16-2101           | FXD C FILM 1K             | OHM 5% 1/6W |           | RD1/6FS   |
| R3                      | 40-16-2101           | FXD C FILM 1K             | OHM 5% 1/6W |           | RD1/6FS   |
| R4                      | 40-16-1221           | FXD C FILM 220            | OHM 5% 1/6W |           | RD1/6FS   |
| R5                      | 40-16-3101           | FXD C FILM 10K            | OHM 5% 1/6W |           | RD1/6FS   |
| R6                      | 40-16-1391           | FXD C FILM 390            | OHM 5% 1/6W |           | RD1/6FS   |
| R7                      | 40-16-1221           | FXD C FILM 220            | OHM 5% 1/6W |           | RD1/6FS   |
| R9                      | 42-80-3101           | FXD M FILM 10K            | OHM 1% 1/6W |           | RN1/6FS   |
| R10                     | 42-80-2271           | FXD M FILM 2.7K           | OHM 1% 1/6W |           | RN1/6FS   |
| R11                     | 42-80-3821           | FXD M FILM 82K            | OHM 1% 1/6W |           | RN1/6FS   |
| R13                     | 40-16-2151           | FXD C FILM 1.5K           | OHM 5% 1/6W |           | RD1/6FS   |
| R14                     | 40-16-1271           | FXD C FILM 270            | OHM 5% 1/6W |           | RD1/6FS   |
| R15                     | 40-16-0001           | FXD C FILM 0              | OHM 5% 1/6W |           | RD1/6FS   |
| R16                     | 40-16-3681           | FXD C FILM 68K            | OHM 5% 1/6W |           | RD1/6FS   |
| R17                     | 40-16-2181           | FXD C FILM 1.8K           | OHM 5% 1/6W |           | RD1/6FS   |
| R18                     | 40-16-2101           | FXD C FILM 1K             | OHM 5% 1/6W |           | RD1/6FS   |
| R19                     | 40-16-0331           | FXD C FILM 33             | OHM 5% 1/6W |           | RD1/6FS   |
| R20                     | 40-16-3561           | FXD C FILM 56K            | OHM 5% 1/6W |           | RD1/6FS   |
| R21                     | 40-16-3181           | FXD C FILM 18K            | OHM 5% 1/6W |           | RD1/6FS   |
| R22                     | 44-91-8101           | FXD M OXIDE 1             | OHM 5% 1W   | MATSUSITA | ERX1ANJ   |
| R23                     | 40-27-3472           | FXD C FILM 47K            | OHM 5% 1/4W |           |           |
| R24                     | 40-27-4152           | FXD C FILM 150K           | OHM 5% 1/4W |           |           |
| R25                     | 40-37-6101           | FXD C FILM 10M            | OHM 5% 1/2W |           |           |
| R26                     | 40-37-6101           | FXD C FILM 10M            | OHM 5% 1/2W |           |           |
| R27                     | 40-27-2332           | FXD C FILM 3.3K           | OHM 5% 1/4W |           |           |
| R28                     | 40-37-5221           | FXD C FILM 2.2M           | OHM 5% 1/2W |           |           |
| R29                     | 40-37-6101           | FXD C FILM 10M            | OHM 5% 1/2W |           |           |
| R30                     | 40-37-6101           | FXD C FILM 10M            | OHM 5% 1/2W |           |           |
| R31                     | 40-27-2102           | FXD C FILM 1K             | OHM 5% 1/4W |           | NAS1/4S   |
| R32                     | 40-27-3822           | FXD C FILM 82K            | OHM 5% 1/4W |           |           |
| R33                     | 42-44-0330           | FXD T FILM 10M            | OHM 1% 1W   |           |           |
| R34                     | 42-34-2190           | FXD M GLAZE 6.8M          | OHM 1% 0.8W |           |           |
| R35                     | 40-27-4472           | FXD C FILM 470K           | OHM 5% 1/4W |           |           |
| R36                     | 40-27-3222           | FXD C FILM 22K            | OHM 5% 1/4W |           |           |
| R37                     | 40-27-4222           | FXD C FILM 220K           | OHM 5% 1/4W |           |           |
| R42                     | 40-16-2561           | FXD C FILM 5.6K           | OHM 5% 1/6W |           | RD1/6FS   |
| R43                     | 40-16-0331           | FXD C FILM 33             | OHM 5% 1/6W |           | RD1/6FS   |
| RV2                     | 48-31-3500           | FXD M GLAZE 50K           | OHM B PH    |           |           |
| RV3                     | 48-26-5221           | VAR M GLAZE 2.2M          | OHM         |           |           |
| RV4                     | 48-31-4100           | VAR M GLAZE 100K          | OHM B PH    |           |           |
| RV5                     | 48-31-4100           | VAR M GLAZE 100K          | OHM B PH    |           |           |
| RV6                     | 48-31-4100           | VAR M GLAZE 100K          | OHM B PH    |           |           |
| U601                    | 36-00-1310           | HIC (H31 HORIZ FINAL AMP) |             | KIKUSUI   | B2709/6   |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                      | 97-11-0040 |            |           |
|-------------------------|----------------------|----------------------------------|------------|------------|-----------|
| U602                    | 34-00-0340           | FET INPUT DUAL OP AMP            |            | TEXAS INS. | TL082CP   |
| A7 ASSEMBLY             |                      |                                  | 97-11-0050 |            |           |
| C1                      | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |            |           |
| C2                      | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |            |           |
| C3                      | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |            |           |
| C4                      | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |            |           |
| C5                      | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |            |           |
| C6                      | 54-20-1210           | FXD ELECT 220MF 16WV             |            | KME16VB220 |           |
| C7                      | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |            |           |
| C8                      | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |            |           |
| CR1                     | 37-00-0440           | LAMP LED RED                     |            | TOSHIBA    | TLUY163   |
| CR2                     | 37-00-0440           | LAMP LED RED                     |            | TOSHIBA    | TLUY163   |
| CR3                     | 37-00-0440           | LAMP LED RED                     |            | TOSHIBA    | TLUY163   |
| DS1                     | 23-43-0000           | LAMP FILAMENT 14V 40MA           |            |            | RM314V40  |
| DS2                     | 23-43-0000           | LAMP FILAMENT 14V 40MA           |            |            | RM314V40  |
| DS3                     | 23-43-0000           | LAMP FILAMENT 14V 40MA           |            |            | RM314V40  |
| Q1                      | 30-11-0151           | TR SI PNP                        |            | TOSHIBA    | 2SA1015-Y |
| Q2                      | 30-30-9451           | TR SI NPN                        |            | NEC        | 2SC945-Q  |
| Q3                      | 30-31-8461           | TR SI NPN                        |            | MATSUSITA  | 2SC1846-R |
| Q4                      | 30-31-8461           | TR SI NPN                        |            | MATSUSITA  | 2SC1846-R |
| Q5                      | 30-30-9451           | TR SI NPN                        |            | NEC        | 2SC945-Q  |
| Q6                      | 30-11-0151           | TR SI PNP                        |            | TOSHIBA    | 2SA1015-Y |
| R1                      | 42-80-2681           | FXD M FILM 6.8K OHM 1% 1/6W      |            |            | RN1/6FS   |
| R2                      | 42-80-2331           | FXD M FILM 3.3K OHM 1% 1/6W      |            |            | RN1/6FS   |
| R3                      | 40-16-1101           | FXD C FILM 100 OHM 5% 1/6W       |            |            | RD1/6FS   |
| R4                      | 42-80-3101           | FXD M FILM 10K OHM 1% 1/6W       |            |            | RN1/6FS   |
| R5                      | 42-80-3101           | FXD M FILM 10K OHM 1% 1/6W       |            |            | RN1/6FS   |
| R6                      | 40-16-1101           | FXD C FILM 100 OHM 5% 1/6W       |            |            | RD1/6FS   |
| R7                      | 40-16-2821           | FXD C FILM 8.2K OHM 5% 1/6W      |            |            | RD1/6FS   |
| R8                      | 40-16-2391           | FXD C FILM 3.9K OHM 5% 1/6W      |            |            | RD1/6FS   |
| R9                      | 40-16-2391           | FXD C FILM 3.9K OHM 5% 1/6W      |            |            | RD1/6FS   |
| R10                     | 40-16-1101           | FXD C FILM 100 OHM 5% 1/6W       |            |            | RD1/6FS   |
| R11                     | 40-16-2221           | FXD C FILM 2.2K OHM 5% 1/6W      |            |            | RD1/6FS   |
| R12                     | 40-16-4101           | FXD C FILM 100K OHM 5% 1/6W      |            |            | RD1/6FS   |
| R14                     | 40-16-2471           | FXD C FILM 4.7K OHM 5% 1/6W      |            |            | RD1/6FS   |
| R15                     | 40-16-2101           | FXD C FILM 1K OHM 5% 1/6W        |            |            | RD1/6FS   |
| R16                     | 40-16-2101           | FXD C FILM 1K OHM 5% 1/6W        |            |            | RD1/6FS   |
| R17                     | 40-16-2101           | FXD C FILM 1K OHM 5% 1/6W        |            |            | RD1/6FS   |
| R18                     | 40-16-3101           | FXD C FILM 10K OHM 5% 1/6W       |            |            | RD1/6FS   |
| RV1                     | 45-01-0810           | VAR C COMP 20K/20K OHM B         | KIKUSUI    |            | V12LG3S   |
| RV2                     | 45-02-0280           | VAR C COMP 20K/20K OHM B         | KIKUSUI    |            | V12LG3N   |
| RV3                     | 45-02-0285           | VAR C COMP 20K/20K OHM B         |            |            | V12LG3N   |
| RV4                     | 45-01-0810           | VAR C COMP 20K/20K OHM B         | KIKUSUI    |            | V12LG3S   |
| S1                      | 81-01-0270           | PUSH SWITCH                      |            | ALPS       | SDG5P-E   |
| U1                      | 34-00-0240           | DUAL OPE-AMP                     |            | NEC        | UPC4558C  |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                      | 97-11-0050        |
|-------------------------|----------------------|----------------------------------|-------------------|
| U2                      | 34-00-0340           | FET INPUT DUAL OP AMP            | TEXAS INS.TL082CP |
| A8 ASSEMBLY             |                      | 97-11-0060                       |                   |
| BT1                     | 94-00-0200           | BATTERY LITHIUM                  | CR14250P31        |
| C1                      | 52-06-3165           | FXD CER 33PF 10% 500V TYPE1      |                   |
| C2                      | 52-06-3165           | FXD CER 33PF 10% 500V TYPE1      |                   |
| C3                      | 55-37-2050           | FXD TANT ELECT 1UF 35V           |                   |
| C4                      | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |                   |
| C6                      | 54-20-1210           | FXD ELECT 220MF 16WV             | KME16VB220        |
| C7                      | 54-20-1210           | FXD ELECT 220MF 16WV             | KME16VB220        |
| C8                      | 52-06-2102           | FXD CER 10P 10% 50V TYPE1        |                   |
| C9                      | 52-01-3305           | FXD CER 470PF 10% 500V TYPE2     |                   |
| C10                     | 52-06-2225           | FXD CER 100PF 10% 50V TYPE1      |                   |
| C11                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C12                     | 52-06-2225           | FXD CER 100PF 10% 50V TYPE1      |                   |
| C14                     | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |                   |
| C15                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C16                     | 52-06-2225           | FXD CER 100PF 10% 50V TYPE1      |                   |
| C18                     | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |                   |
| C21                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C22                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C23                     | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |                   |
| C24                     | 52-06-3165           | FXD CER 33PF 10% 500V TYPE1      |                   |
| C25                     | 52-06-3165           | FXD CER 33PF 10% 500V TYPE1      |                   |
| C26                     | 54-20-1210           | FXD ELECT 220MF 16WV             | KME16VB220        |
| C27                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C28                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C29                     | 54-20-1210           | FXD ELECT 220MF 16WV             | KME16VB220        |
| C30                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C31                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C32                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C33                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C34                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C35                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C36                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C37                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C38                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C39                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C40                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C41                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C42                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C43                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C44                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C45                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C46                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C47                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C48                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C49                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C51                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C52                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C53                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C54                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |



REFERENCE KIKUSUI  
SIGNATOR PARTS NO. DESCRIPTION 97-11-0060

|    |            |         |         |     |     |       |
|----|------------|---------|---------|-----|-----|-------|
| 55 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 56 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 57 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 58 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 59 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 61 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 62 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 63 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 64 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 65 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 66 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 67 | 52-37-1000 | FXD CER | 0.047UF | 20% | 25V | TYPE1 |
| 68 | 52-06-2225 | FXD CER | 100PF   | 10% | 50V | TYPE1 |
| 69 | 52-06-2225 | FXD CER | 100PF   | 10% | 50V | TYPE1 |
| 70 | 52-06-2184 | FXD CER | 47PF    | 10% | 50V | TYPE1 |

|     |            |                     |        |         |          |
|-----|------------|---------------------|--------|---------|----------|
| R1  | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R2  | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R3  | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R4  | 32-92-0033 | ZENER VZ=3.2 - 3.4V |        | HITACHI | HZ3C-2   |
| R5  | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R6  | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R7  | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R8  | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R9  | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R10 | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R11 | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R12 | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R13 | 32-30-1200 | DIODE VR=60V        | IO=1A  | HITACHI | 1SS120   |
| R14 | 32-92-0056 | ZENER VZ=5.5 - 5.8V | P=0.4W | NEC     | RD5.6JB2 |

|   |            |           |  |         |           |
|---|------------|-----------|--|---------|-----------|
| 1 | 30-11-0151 | TR SI PNP |  | TOSHIBA | 2SA1015-Y |
| 2 | 30-30-9451 | TR SI NPN |  | NEC     | 2SC945-Q  |
| 3 | 30-11-0151 | TR SI PNP |  | TOSHIBA | 2SA1015-Y |
| 4 | 30-11-0051 | TR SI PNP |  | NEC     | 2SA1005-L |
| 5 | 30-11-0051 | TR SI PNP |  | NEC     | 2SA1005-L |
| 6 | 30-30-9451 | TR SI NPN |  | NEC     | 2SC945-Q  |
| 7 | 30-11-0151 | TR SI PNP |  | TOSHIBA | 2SA1015-Y |

|    |            |            |      |        |      |         |
|----|------------|------------|------|--------|------|---------|
| 1  | 40-16-5101 | FXD C FILM | 1M   | OHM 5% | 1/6W | RD1/6FS |
| 2  | 40-16-2331 | FXD C FILM | 3.3K | OHM 5% | 1/6W | RD1/6FS |
| 3  | 40-16-2561 | FXD C FILM | 5.6K | OHM 5% | 1/6W | RD1/6FS |
| 4  | 40-16-0101 | FXD C FILM | 10   | OHM 5% | 1/6W | RD1/6FS |
| 5  | 40-16-1821 | FXD C FILM | 820  | OHM 5% | 1/6W | RD1/6FS |
| 6  | 42-80-3471 | FXD M FILM | 47K  | OHM 1% | 1/6W | RN1/6FS |
| 7  | 42-80-2221 | FXD M FILM | 2.2K | OHM 1% | 1/6W | RN1/6FS |
| 9  | 40-16-1331 | FXD C FILM | 330  | OHM 5% | 1/6W | RD1/6FS |
| 10 | 40-16-2331 | FXD C FILM | 3.3K | OHM 5% | 1/6W | RD1/6FS |
| 11 | 40-16-2331 | FXD C FILM | 3.3K | OHM 5% | 1/6W | RD1/6FS |
| 12 | 40-16-2561 | FXD C FILM | 5.6K | OHM 5% | 1/6W | RD1/6FS |
| 13 | 42-80-2331 | FXD M FILM | 3.3K | OHM 1% | 1/6W | RN1/6FS |
| 14 | 42-80-2471 | FXD M FILM | 4.7K | OHM 1% | 1/6W | RN1/6FS |
| 15 | 40-16-2221 | FXD C FILM | 2.2K | OHM 5% | 1/6W | RD1/6FS |
| 16 | 40-16-1681 | FXD C FILM | 680  | OHM 5% | 1/6W | RD1/6FS |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                   | 97-11-0060       |            |
|-------------------------|----------------------|-------------------------------|------------------|------------|
| R17                     | 44-07-0070           | FXD M GLAZE R-NET             | 3.3K OHM X8      |            |
| R18                     | 44-07-0150           | FXD M GLAZE R-NET             | 4.7K OHM X4      |            |
| R24                     | 40-16-3221           | FXD C FILM                    | 22K OHM 5% 1/6W  | RD1/6FS    |
| R25                     | 40-16-2101           | FXD C FILM                    | 1K OHM 5% 1/6W   | RD1/6FS    |
| R26                     | 40-16-1821           | FXD C FILM                    | 820 OHM 5% 1/6W  | RD1/6FS    |
| R27                     | 40-16-2101           | FXD C FILM                    | 1K OHM 5% 1/6W   | RD1/6FS    |
| R28                     | 40-16-2181           | FXD C FILM                    | 1.8K OHM 5% 1/6W | RD1/6FS    |
| R29                     | 40-16-2181           | FXD C FILM                    | 1.8K OHM 5% 1/6W | RD1/6FS    |
| R30                     | 40-16-1101           | FXD C FILM                    | 100 OHM 5% 1/6W  | RD1/6FS    |
| R31                     | 40-16-1391           | FXD C FILM                    | 390 OHM 5% 1/6W  | RD1/6FS    |
| R32                     | 42-80-2151           | FXD M FILM                    | 1.5K OHM 1% 1/6W | RN1/6FS    |
| R33                     | 42-80-2331           | FXD M FILM                    | 3.3K OHM 1% 1/6W | RN1/6FS    |
| R34                     | 40-16-2471           | FXD C FILM                    | 4.7K OHM 5% 1/6W | RD1/6FS    |
| R35                     | 40-16-5101           | FXD C FILM                    | 1M OHM 5% 1/6W   | RD1/6FS    |
| R36                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R37                     | 40-16-3561           | FXD C FILM                    | 56K OHM 5% 1/6W  | RD1/6FS    |
| R38                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R39                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R40                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R41                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R42                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R43                     | 42-80-2561           | FXD M FILM                    | 5.6K OHM 1% 1/6W | RN1/6FS    |
| R44                     | 40-16-2271           | FXD C FILM                    | 2.7K OHM 5% 1/6W | RD1/6FS    |
| R45                     | 42-80-3101           | FXD M FILM                    | 10K OHM 1% 1/6W  | RN1/6FS    |
| R46                     | 42-80-2391           | FXD M FILM                    | 3.9K OHM 1% 1/6W | RN1/6FS    |
| R47                     | 42-80-1271           | FXD M FILM                    | 270 OHM 1% 1/6W  | RN1/6FS    |
| R48                     | 42-80-1681           | FXD M FILM                    | 680 OHM 1% 1/6W  | RN1/6FS    |
| R49                     | 42-80-1471           | FXD M FILM                    | 470 OHM 1% 1/6W  | RN1/6FS    |
| R50                     | 42-80-2471           | FXD M FILM                    | 4.7K OHM 1% 1/6W | RN1/6FS    |
| R51                     | 40-16-1221           | FXD C FILM                    | 220 OHM 5% 1/6W  | RD1/6FS    |
| R52                     | 42-80-3101           | FXD M FILM                    | 10K OHM 1% 1/6W  | RN1/6FS    |
| R53                     | 42-80-2821           | FXD M FILM                    | 8.2K OHM 1% 1/6W | RN1/6FS    |
| R54                     | 42-80-1471           | FXD M FILM                    | 470 OHM 1% 1/6W  | RN1/6FS    |
| R55                     | 42-80-1681           | FXD M FILM                    | 680 OHM 1% 1/6W  | RN1/6FS    |
| R56                     | 42-80-1271           | FXD M FILM                    | 270 OHM 1% 1/6W  | RN1/6FS    |
| R57                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R58                     | 42-80-1101           | FXD M FILM                    | 100 OHM 1% 1/6W  | RN1/6FS    |
| R59                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R60                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R61                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R63                     | 40-16-2331           | FXD C FILM                    | 3.3K OHM 5% 1/6W | RD1/6FS    |
| R64                     | 40-16-1101           | FXD C FILM                    | 100 OHM 5% 1/6W  | RD1/6FS    |
| R65                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| RV1                     | 48-37-3100           | VAR M FILM                    | 10K OHM B        | VM5CKPV    |
| U01                     | 35-70-0746           | DUAL D F-F EDGE TRIGGER       | TOSHIBA          | TC74HC74P  |
| U05                     | 35-70-0046           | HEX INVERTERS                 | TOSHIBA          | TC74HC04P  |
| U06                     | 35-70-1396           | 2LINE TO 4LINE DECORDER       | TOSHIBA          | TC74HC139P |
| U07                     | 35-70-0086           | QUAD 2-INPUT POSI-AND         | TOSHIBA          | TC74HC08P  |
| U11                     | 35-70-0746           | DUAL D F-F EDGE TRIGGER       | TOSHIBA          | TC74HC74P  |
| U12                     | 36-90-0110           | Z80A-CPU 4MHZ                 | SHARP            | LH0080A    |
| U13                     | 35-05-0010           | EPROM 32K X 8BIT 250NS (CMOS) |                  | 27C256     |
| U15                     | 35-56-0111           | S-RAM 2KX8BIT CMOS            | HITACHI          | HM6116P-3  |

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO. DESCRIPTION 97-11-0060

|      |            |                                |            |            |
|------|------------|--------------------------------|------------|------------|
| U16  | 35-53-0304 | 8-INPUT POSI-NAND GATE         | TOSIHBA    | TC74HC30P  |
| U18  | 35-70-1646 | 8BIT PARALOAD SHIFTREGISTER    | HITACHI    | HD74HC164P |
| U21  | 35-70-1576 | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U26  | 34-44-0010 | RESET IC                       | TEXAS INS. | TL7705CP   |
| U28  | 35-70-0006 | QUAD 2-INPUT POSI-NAND         | TOSHIBA    | TC74HC00P  |
| U33  | 35-56-0080 | S-RAM 2KW X 8BIT 200NS         | HITACHI    | HM6117LP-4 |
| U34  | 35-53-2454 | OCTAL BUS TRANSCEIVER          | TOSHIBA    | TC74HC245P |
| U36  | 35-53-5414 | OCTAL BUFFER                   | TEXAS INS. | SN7HCS541N |
| U37  | 35-53-1744 | HEX D-TYPE FLIP FLOP           | TOSHIBA    | TC74HC174P |
| U38  | 35-70-2991 | 8 BIT SHIFT RESISTER           | TEXAS INS. | SN74LS299N |
| U41  | 35-70-1576 | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U42  | 35-70-1576 | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U43  | 35-70-1576 | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U45  | 35-70-1386 | 3LINE TO 8LINE DECORDER        | HITACHI    | HD74HC138P |
| U46  | 35-70-1396 | 2LINE TO 4LINE DECORDER        | TOSHIBA    | TC74HC139P |
| U47  | 35-70-0326 | QUAD 2-INPUT POSI-OR           | TOSHIBA    | TC74HC32P  |
| U51  | 35-53-1074 | DUAL J-K F-F WITH P/C          | TOSHIBA    | TC74HC107P |
| U52  | 35-56-0665 | QUAD BILATERAL SWITCH          | TOSHIBA    | TC74HC4066 |
| U53  | 35-70-0111 | TRI 3-INPUT POSI-AND           | HITACHI    | HD74LS11P  |
| U54  | 35-53-3904 | DUAL DECADE COUNTERS           | TOSHIBA    | TC74HC390P |
| U55  | 35-53-3904 | DUAL DECADE COUNTERS           | TOSHIBA    | TC74HC390P |
| U56  | 35-53-2574 | QUAD DATA SELEC./MULTI.        | TOSHIBA    | TC74HC257P |
| U57  | 35-70-0326 | QUAD 2-INPUT POSI-OR           | TOSHIBA    | TC74HC32P  |
| U61  | 35-70-0046 | HEX INVERTERS                  | TOSHIBA    | TC74HC04P  |
| U62  | 35-56-0945 | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA    | TC74HC4094 |
| U63  | 35-53-1074 | DUAL J-K F-F WITH P/C          | TOSHIBA    | TC74HC107P |
| U64  | 35-56-0665 | QUAD BILATERAL SWITCH          | TOSHIBA    | TC74HC4066 |
| U65  | 35-70-0746 | DUAL D F-F EDGE TRIGGER        | TOSHIBA    | TC74HC74P  |
| U66  | 35-57-0530 | 3 DIG BCD COUNTER              | MOTOROLA   | MC14553B   |
| U67  | 35-53-2574 | QUAD DATA SELEC./MULTI.        | TOSHIBA    | TC74HC257P |
| U71  | 35-73-5900 | 8 BIT BINARY COUNTER/RESISTERS | TEXAS INS. | SN74LS590N |
| U72  | 35-42-0010 | P ROM 32 X 8BIT 25NS           | TEXAS INS. | TBP18S030N |
| U73  | 35-70-5746 | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA    | TC74HC574P |
| U74  | 35-70-0086 | QUAD 2-INPUT POSI-AND          | TOSHIBA    | TC74HC08P  |
| U75  | 35-53-3934 | DUAL 4 BIT BINALY COUNTER      | TOSHIBA    | TC74HC393P |
| U76  | 35-73-5900 | 8 BIT BINARY COUNTER/RESISTERS | TEXAS INS. | SN74LS590N |
| U77  | 35-53-5414 | OCTAL BUFFER                   | TEXAS INS. | SN7HCS541N |
| U78  | 35-53-1254 | QUAD BUS BUFFER GATES (3-ST)   | TOSHIBA    | TC74HC125P |
| U81  | 35-70-0746 | DUAL D F-F EDGE TRIGGER        | TOSHIBA    | TC74HC74P  |
| U82  | 35-70-0326 | QUAD 2-INPUT POSI-OR           | TOSHIBA    | TC74HC32P  |
| U83  | 35-53-0144 | HEX SHMITT-TRIG INVERTER       | TOSHIBA    | TC74HC14P  |
| U84  | 35-70-0046 | HEX INVERTERS                  | TOSHIBA    | TC74HC04P  |
| U85  | 35-56-0111 | S-RAM 2KX8BIT CMOS             | HITACHI    | HM6116P-3  |
| U86  | 35-70-5746 | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA    | TC74HC574P |
| U87  | 35-53-2454 | OCTAL BUS TRANSCEIVER          | TOSHIBA    | TC74HC245P |
| U91  | 35-53-3904 | DUAL DECADE COUNTERS           | TOSHIBA    | TC74HC390P |
| U92  | 34-69-0080 | TRIPLE 8-CHANNEL MULTIPLEXER   | TOSHIBA    | TC4051BP   |
| U93  | 34-69-0030 | TRIPLE 2-CHANNEL MULTIPLEXER   | TOSHIBA    | TC4053BP   |
| U94  | 35-53-3934 | DUAL 4 BIT BINALY COUNTER      | TOSHIBA    | TC74HC393P |
| U101 | 35-53-3904 | DUAL DECADE COUNTERS           | TOSHIBA    | TC74HC390P |
| U102 | 35-56-0945 | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA    | TC74HC4094 |
| U103 | 35-70-0086 | QUAD 2-INPUT POSI-AND          | TOSHIBA    | TC74HC08P  |
| U104 | 35-70-5746 | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA    | TC74HC574P |
| U105 | 35-05-0010 | EPROM 32K X 8BIT 250NS (CMOS)  |            | 27C256     |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                | 97-11-0060 |            |  |
|-------------------------|----------------------|----------------------------|------------|------------|--|
| U106                    | 35-70-0086           | QUAD 2-INPUT POSI-AND      | TOSHIBA    | TC74HC08P  |  |
| U107                    | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER | TOSHIBA    | TC74HC4094 |  |
| U112                    | 35-70-0046           | HEX INVERTERS              | TOSHIBA    | TC74HC04P  |  |
| U113                    | 35-70-0746           | DUAL D F-F EDGE TRIGGER    | TOSHIBA    | TC74HC74P  |  |
| U114                    | 34-22-0010           | D/A CONVERTER 8BIT 85NS    | HITACHI    | HA17008RP  |  |
| U115                    | 35-70-1736           | 4 BIT D TYPE RESISTERS     | TOSHIBA    | TC74HC173P |  |
| U116                    | 34-22-0010           | D/A CONVERTER 8BIT 85NS    | HITACHI    | HA17008RP  |  |
| U117                    | 34-00-0340           | FET INPUT DUAL OP AMP      | TEXAS INS. | TL082CP    |  |
| U118                    | 34-69-0070           | ANALOG MULTIPLEXER         | HITACHI    | HD14052B   |  |
| X1                      | 93-00-0180           | QUARTS HC-49/U 8MHZ        | KIKUSUI    | S8409201   |  |
| X2                      | 93-00-0230           | QUARTS HC-49/U 10MHZ (AT)  | KIKUSUI    | S8510031   |  |



REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0070

A10 ASSEMBLY

|     |            |                |         |         |       |         |            |
|-----|------------|----------------|---------|---------|-------|---------|------------|
| C1  | 52-01-3365 | FXD CER        | 1500PF  | 10%     | 50V   | TYPE2   |            |
| C2  | 52-01-3365 | FXD CER        | 1500PF  | 10%     | 50V   | TYPE2   |            |
| C3  | 52-01-3365 | FXD CER        | 1500PF  | 10%     | 50V   | TYPE2   |            |
| C4  | 52-01-3365 | FXD CER        | 1500PF  | 10%     | 50V   | TYPE2   |            |
| C5  | 52-01-3365 | FXD CER        | 1500PF  | 10%     | 50V   | TYPE2   |            |
| C6  | 52-01-3365 | FXD CER        | 1500PF  | 10%     | 50V   | TYPE2   |            |
| C7  | 50-67-0030 | FXD PLSTC FILM | 0.01MF  | 10%     | 100WV |         |            |
| C8  | 55-37-2100 | FXD TANT ELECT | 10UF    |         | 35V   |         |            |
| C9  | 52-05-2468 | FXD CER        | 0.01UF  | +80-20% | 50V   | TYPE2   |            |
| C10 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C11 | 52-05-2468 | FXD CER        | 0.01UF  | +80-20% | 50V   | TYPE2   |            |
| C12 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C13 | 52-06-2225 | FXD CER        | 100PF   | 10%     | 50V   | TYPE1   |            |
| C15 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C16 | 52-01-2305 | FXD CER        | 470PF   | 10%     | 50V   | TYPE2   |            |
| C17 | 52-06-2184 | FXD CER        | 47PF    | 10%     | 50V   | TYPE1   |            |
| C18 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C19 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C20 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C21 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C22 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C23 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C24 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C25 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C26 | 54-30-1960 | FXD ELECT      | 47MF    |         | 25WV  |         |            |
| C27 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C28 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C29 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C30 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C31 | 54-30-1960 | FXD ELECT      | 47MF    |         | 25WV  |         |            |
| C32 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C33 | 54-40-1200 | FXD ELECT      | 10MF    |         | 50WV  |         |            |
| C34 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C35 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C36 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C37 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C38 | 52-37-1000 | FXD CER        | 0.047UF | 20%     | 25V   | TYPE1   |            |
| C39 | 54-20-1220 | FXD ELECT      | 470MF   |         | 16WV  |         | KME16VB470 |
| CR1 | 32-30-1200 | DIODE          | VR=60V  | IO=1A   |       | HITACHI | 1SS120     |
| CR2 | 32-30-1200 | DIODE          | VR=60V  | IO=1A   |       | HITACHI | 1SS120     |
| CR3 | 32-30-1200 | DIODE          | VR=60V  | IO=1A   |       | HITACHI | 1SS120     |
| R1  | 40-16-4101 | FXD C FILM     | 100K    | OHM     | 5%    | 1/6W    | RD1/6FS    |
| R2  | 40-16-4101 | FXD C FILM     | 100K    | OHM     | 5%    | 1/6W    | RD1/6FS    |
| R3  | 40-16-4101 | FXD C FILM     | 100K    | OHM     | 5%    | 1/6W    | RD1/6FS    |
| R4  | 40-16-4101 | FXD C FILM     | 100K    | OHM     | 5%    | 1/6W    | RD1/6FS    |
| R5  | 40-16-4101 | FXD C FILM     | 100K    | OHM     | 5%    | 1/6W    | RD1/6FS    |
| R6  | 40-16-4101 | FXD C FILM     | 100K    | OHM     | 5%    | 1/6W    | RD1/6FS    |
| R8  | 40-16-2271 | FXD C FILM     | 2.7K    | OHM     | 5%    | 1/6W    | RD1/6FS    |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                   | 97-11-0070  |            |
|-------------------------|----------------------|-------------------------------|-------------|------------|
| R9                      | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R10                     | 40-16-4101           | FXD C FILM 100K               | OHM 5% 1/6W | RD1/6FS    |
| R11                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R12                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R13                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R14                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R15                     | 42-80-2101           | FXD M FILM 1K                 | OHM 1% 1/6W | RN1/6FS    |
| R16                     | 42-80-2101           | FXD M FILM 1K                 | OHM 1% 1/6W | RN1/6FS    |
| R17                     | 42-80-2101           | FXD M FILM 1K                 | OHM 1% 1/6W | RN1/6FS    |
| R18                     | 42-80-2391           | FXD M FILM 3.9K               | OHM 1% 1/6W | RN1/6FS    |
| R19                     | 42-80-2391           | FXD M FILM 3.9K               | OHM 1% 1/6W | RN1/6FS    |
| R21                     | 40-16-1101           | FXD C FILM 100                | OHM 5% 1/6W | RD1/6FS    |
| R22                     | 40-16-0221           | FXD C FILM 22                 | OHM 5% 1/6W | RD1/6FS    |
| R23                     | 40-16-1101           | FXD C FILM 100                | OHM 5% 1/6W | RD1/6FS    |
| R24                     | 40-16-1101           | FXD C FILM 100                | OHM 5% 1/6W | RD1/6FS    |
| R25                     | 40-16-2471           | FXD C FILM 4.7K               | OHM 5% 1/6W | RD1/6FS    |
| R26                     | 40-16-4101           | FXD C FILM 100K               | OHM 5% 1/6W | RD1/6FS    |
| R27                     | 40-16-2471           | FXD C FILM 4.7K               | OHM 5% 1/6W | RD1/6FS    |
| R28                     | 40-16-4101           | FXD C FILM 100K               | OHM 5% 1/6W | RD1/6FS    |
| R29                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R30                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R32                     | 40-16-2561           | FXD C FILM 5.6K               | OHM 5% 1/6W | RD1/6FS    |
| R33                     | 40-16-2221           | FXD C FILM 2.2K               | OHM 5% 1/6W | RD1/6FS    |
| R35                     | 40-16-2561           | FXD C FILM 5.6K               | OHM 5% 1/6W | RD1/6FS    |
| R36                     | 40-16-2221           | FXD C FILM 2.2K               | OHM 5% 1/6W | RD1/6FS    |
| R37                     | 40-16-2471           | FXD C FILM 4.7K               | OHM 5% 1/6W | RD1/6FS    |
| R38                     | 40-16-2471           | FXD C FILM 4.7K               | OHM 5% 1/6W | RD1/6FS    |
| R39                     | 40-16-0101           | FXD C FILM 10                 | OHM 5% 1/6W | RD1/6FS    |
| R40                     | 40-16-0101           | FXD C FILM 10                 | OHM 5% 1/6W | RD1/6FS    |
| R41                     | 40-27-0102           | FXD C FILM 10                 | OHM 5% 1/4W | NAS1/4S    |
| R43                     | 42-80-2101           | FXD M FILM 1K                 | OHM 1% 1/6W | RN1/6FS    |
| R44                     | 42-80-1151           | FXD M FILM 150                | OHM 1% 1/6W | RN1/6FS    |
| R45                     | 40-16-3471           | FXD C FILM 47K                | OHM 5% 1/6W | RD1/6FS    |
| U1                      | 35-57-0840           | HEX SCHMITT TRIGGER           | TOSHIBA     | TC4584BP   |
| U2                      | 35-70-0086           | QUAD 2-INPUT POSI-AND         | TOSHIBA     | TC74HC08P  |
| U3                      | 35-70-1936           | 4 BIT UP/DOWN BINARY COUNTERS | TOSHIBA     | TC74HC193P |
| U4                      | 35-70-1936           | 4 BIT UP/DOWN BINARY COUNTERS | TOSHIBA     | TC74HC193P |
| U5                      | 35-70-1936           | 4 BIT UP/DOWN BINARY COUNTERS | TOSHIBA     | TC74HC193P |
| U6                      | 35-69-0010           | DUAL MONOSTABLE MULTI         | MOTOROLA    | MC14538BCP |
| U7                      | 35-53-5414           | OCTAL BUFFER                  | TEXAS INS.  | SN7HCS541N |
| U8                      | 35-53-5414           | OCTAL BUFFER                  | TEXAS INS.  | SN7HCS541N |
| U9                      | 35-70-1386           | 3LINE TO 8LINE DECORDER       | HITACHI     | HD74HC138P |
| U10                     | 35-70-0326           | QUAD 2-INPUT POSI-OR          | TOSHIBA     | TC74HC32P  |
| U11                     | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F    | TOSHIBA     | TC74HC574P |
| U12                     | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F    | TOSHIBA     | TC74HC574P |
| U13                     | 36-20-0100           | D/A CONVERTER 12BIT           | HITACHI     | HA17012PB  |
| U14                     | 34-00-0390           | FET INPUT DUAL OP AMP         | NEC         | UPC812C    |
| U15                     | 34-20-0130           | DUAL COMPARATORS              | HITACHI     | HA17903PS  |
| U16                     | 35-53-3654           | HEX BUS DRIVERS               | TOSHIBA     | TC74HC365P |
| U17                     | 35-02-0020           | PROG.KEY & DISP CONTROL       | NEC         | UPD8279C-  |
| U18                     | 35-53-0304           | 8-INPUT POSI-NAND GATE        | TOSIHBA     | TC74HC30P  |
| U19                     | 35-70-0046           | HEX INVERTERS                 | TOSHIBA     | TC74HC04P  |
| U20                     | 34-00-0340           | FET INPUT DUAL OP AMP         | TEXAS INS.  | TL082CP    |

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0261

A11 ASSEMBLY

|      |            |           |         |               |                 |
|------|------------|-----------|---------|---------------|-----------------|
| C1   | 54-40-1200 | FXD ELECT | 10MF    | 50WV          |                 |
| C2   | 54-20-1210 | FXD ELECT | 220MF   | 16WV          | KME16VB220      |
| C3   | 54-40-1200 | FXD ELECT | 10MF    | 50WV          |                 |
| C4   | 54-20-1210 | FXD ELECT | 220MF   | 16WV          | KME16VB220      |
| C5   | 54-40-1200 | FXD ELECT | 10MF    | 50WV          |                 |
| C6   | 54-40-1200 | FXD ELECT | 10MF    | 50WV          |                 |
| C7   | 52-37-1000 | FXD CER   | 0.047UF | 20% 25V TYPE1 |                 |
| C8   | 54-40-1200 | FXD ELECT | 10MF    | 50WV          |                 |
| CR1  | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR3  | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR4  | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR5  | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR7  | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR8  | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR11 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR12 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR13 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR14 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR15 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR16 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR17 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR18 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR21 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR22 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR23 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR24 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR25 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR26 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR27 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR28 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR31 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR32 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR33 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR34 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR35 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR36 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR37 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR38 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR41 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR42 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR43 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR44 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR45 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR46 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR47 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR48 | 37-00-0430 | LAMP LED  | GREEN   |               | TOSHIBA TLUG163 |
| CR51 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR52 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |
| CR53 | 37-00-0440 | LAMP LED  | RED     |               | TOSHIBA TLUY163 |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION     | 97-11-0261  |           |         |
|-------------------------|----------------------|-----------------|-------------|-----------|---------|
| CR54                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR55                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR56                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR57                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR58                    | 37-00-0430           | LAMP LED GREEN  | TOSHIBA     | TLUG163   |         |
| CR61                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR62                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR63                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR64                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR65                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR66                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR67                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR81                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR82                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR83                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR84                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR85                    | 37-00-0430           | LAMP LED GREEN  | TOSHIBA     | TLUG163   |         |
| CR86                    | 37-00-0430           | LAMP LED GREEN  | TOSHIBA     | TLUG163   |         |
| CR87                    | 37-00-0430           | LAMP LED GREEN  | TOSHIBA     | TLUG163   |         |
| CR88                    | 37-00-0430           | LAMP LED GREEN  | TOSHIBA     | TLUG163   |         |
| CR93                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR94                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR95                    | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR101                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR102                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR103                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR104                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR105                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR106                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR111                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR112                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR113                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR114                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR115                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR116                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR117                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR118                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR121                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| CR122                   | 37-00-0440           | LAMP LED RED    | TOSHIBA     | TLUY163   |         |
| L1                      | 67-10-0890           | INDUCTOR 100MH  | 10%         |           |         |
| L2                      | 67-10-0890           | INDUCTOR 100MH  | 10%         |           |         |
| Q1                      | 30-11-0151           | TR SI PNP       | TOSHIBA     | 2SA1015-Y |         |
| R1                      | 40-16-0221           | FXD C FILM 22   | OHM 5% 1/6W |           | RD1/6FS |
| R2                      | 40-16-0221           | FXD C FILM 22   | OHM 5% 1/6W |           | RD1/6FS |
| R3                      | 40-16-0221           | FXD C FILM 22   | OHM 5% 1/6W |           | RD1/6FS |
| R4                      | 40-16-0221           | FXD C FILM 22   | OHM 5% 1/6W |           | RD1/6FS |
| R5                      | 40-16-0221           | FXD C FILM 22   | OHM 5% 1/6W |           | RD1/6FS |
| R6                      | 40-16-0221           | FXD C FILM 22   | OHM 5% 1/6W |           | RD1/6FS |
| R7                      | 40-16-0221           | FXD C FILM 22   | OHM 5% 1/6W |           | RD1/6FS |
| R8                      | 40-16-0221           | FXD C FILM 22   | OHM 5% 1/6W |           | RD1/6FS |
| R9                      | 40-16-2471           | FXD C FILM 4.7K | OHM 5% 1/6W |           | RD1/6FS |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION        | 97-11-0261  |                   |
|-------------------------|----------------------|--------------------|-------------|-------------------|
| R10                     | 40-16-2101           | FXD C FILM 1K      | OHM 5% 1/6W | RD1/6FS           |
| R12                     | 40-16-1331           | FXD C FILM 330     | OHM 5% 1/6W | RD1/6FS           |
| R13                     | 44-07-0020           | FXD M GLAZE R-NET  | 10K OHM X4  |                   |
| R15                     | 40-16-3101           | FXD C FILM 10K     | OHM 5% 1/6W | RD1/6FS           |
| R16                     | 40-16-3101           | FXD C FILM 10K     | OHM 5% 1/6W | RD1/6FS           |
| RV1                     | 45-01-0820           | VAR C COMP         |             | KIKUSUI V12L5DM1S |
| RV2                     | 45-01-0820           | VAR C COMP         |             | KIKUSUI V12L5DM1S |
| RV3                     | 45-01-0830           | VAR C COMP         |             | KIKUSUI V12L5DM1S |
| RV4                     | 45-02-0280           | VAR C COMP 20K/20K | OHM B       | KIKUSUI V12LG3N   |
| RV5                     | 45-01-0810           | VAR C COMP 20K/20K | OHM B       | KIKUSUI V12LG3S   |
| RV6                     | 45-02-0280           | VAR C COMP 20K/20K | OHM B       | KIKUSUI V12LG3N   |
| RV7                     | 45-02-0280           | VAR C COMP 20K/20K | OHM B       | KIKUSUI V12LG3N   |
| RV8                     | 45-01-0810           | VAR C COMP 20K/20K | OHM B       | KIKUSUI V12LG3S   |
| RV9                     | 45-02-0280           | VAR C COMP 20K/20K | OHM B       | KIKUSUI V12LG3N   |
| RV10                    | 45-01-0810           | VAR C COMP 20K/20K | OHM B       | KIKUSUI V12LG3S   |
| S1                      | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S2                      | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S3                      | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S4                      | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S5                      | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S6                      | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S11                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S12                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S13                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S14                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S15                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S16                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S21                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S22                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S23                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S24                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S25                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S26                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S27                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S28                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S31                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S32                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S33                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S34                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S35                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S36                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S37                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S41                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S43                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S44                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S45                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S46                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S49                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S51                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S52                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S55                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |
| S61                     | 81-01-0870           | PUSH SWITCH        |             | TM1-01            |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION             | 97-11-0261 |            |
|-------------------------|----------------------|-------------------------|------------|------------|
| S62                     | 81-01-0870           | PUSH SWITCH             |            | TM1-01     |
| S63                     | 81-01-0870           | PUSH SWITCH             |            | TM1-01     |
| S64                     | 81-01-0870           | PUSH SWITCH             |            | TM1-01     |
| S65                     | 81-01-0870           | PUSH SWITCH             |            | TM1-01     |
| S66                     | 81-01-0870           | PUSH SWITCH             |            | TM1-01     |
| S67                     | 81-01-0870           | PUSH SWITCH             |            | TM1-01     |
| S68                     | 81-01-0870           | PUSH SWITCH             |            | TM1-01     |
| S71                     | 81-01-0870           | PUSH SWITCH             |            | TM1-01     |
| S107                    | 81-01-0860           | PUSH SWITCH             | ALPS       | SSCTP1     |
| U1                      | 35-91-0010           | 8-LINE DRIVER           | TOSHIBA    | TD62381P   |
| U2                      | 35-70-1386           | 3LINE TO 8LINE DECORDER | HITACHI    | HD74HC138P |
| U3                      | 35-91-0020           | 8-LINE DRIVER           | TOSHIBA    | TD62785P   |
| U4                      | 35-70-1386           | 3LINE TO 8LINE DECORDER | HITACHI    | HD74HC138P |
| U5                      | 35-91-0020           | 8-LINE DRIVER           | TOSHIBA    | TD62785P   |
| U6                      | 35-62-0010           | 8-CH ANALOG MULTI-PLX   | HITACHI    | HD14051BP  |
| U7                      | 35-62-0010           | 8-CH ANALOG MULTI-PLX   | HITACHI    | HD14051BP  |
| U8                      | 35-70-1386           | 3LINE TO 8LINE DECORDER | HITACHI    | HD74HC138P |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION             | 97-11-0280                    |
|-------------------------|----------------------|-------------------------|-------------------------------|
| 12 ASSEMBLY             |                      |                         |                               |
| C1                      | 52-77-1010           | FXD CER 1000PF          | 250VAC FOR UL & CSA           |
| C2                      | 52-77-1010           | FXD CER 1000PF          | 250VAC FOR UL & CSA           |
| C3                      | 50-77-3510           | FXD PLSTC FILM 0.1MF    | 20% 250AC                     |
| C4                      | 54-80-1110           | FXD ELECT 120MF         | 400WV KME400VNSN              |
| C5                      | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C6                      | 54-30-1960           | FXD ELECT 47MF          | 25WV                          |
| C7                      | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C8                      | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C9                      | 52-01-4030           | FXD CER 220PF           | 10% 1KWV MATSUSITA ECKD3A221K |
| C10                     | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C11                     | 50-67-0000           | FXD PLSTC FILM 0.001MF  | 10% 100WV                     |
| C12                     | 52-01-3345           | FXD CER 1000PF          | 10% 500V TYPE2                |
| C13                     | 50-67-0060           | FXD PLSTC FILM 0.1MF    | 10% 100WV                     |
| C14                     | 54-30-1960           | FXD ELECT 47MF          | 25WV                          |
| C16                     | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C17                     | 52-01-4030           | FXD CER 220PF           | 10% 1KWV MATSUSITA ECKD3A221K |
| C18                     | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C19                     | 50-67-0000           | FXD PLSTC FILM 0.001MF  | 10% 100WV                     |
| C20                     | 52-01-3345           | FXD CER 1000PF          | 10% 500V TYPE2                |
| C21                     | 50-67-0060           | FXD PLSTC FILM 0.1MF    | 10% 100WV                     |
| C22                     | 54-30-1960           | FXD ELECT 47MF          | 25WV                          |
| C32                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C33                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C34                     | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C35                     | 50-67-0010           | FXD PLSTC FILM 0.0022MF | 10% 100WV                     |
| C38                     | 54-30-2800           | FXD ELECT 680MF         | 35WV SXE35VB680               |
| C39                     | 54-30-2800           | FXD ELECT 680MF         | 35WV SXE35VB680               |
| C41                     | 54-30-2800           | FXD ELECT 680MF         | 35WV SXE35VB680               |
| C42                     | 54-30-2800           | FXD ELECT 680MF         | 35WV SXE35VB680               |
| C43                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C44                     | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C45                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C46                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C47                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C48                     | 54-30-2790           | FXD ELECT 82MF          | 35WV SXE35VB82                |
| C49                     | 54-30-2780           | FXD ELECT 330MF         | 35WV SXE35VB330               |
| C50                     | 54-30-2780           | FXD ELECT 330MF         | 35WV SXE35VB330               |
| C51                     | 54-20-1190           | FXD ELECT 680MF         | 16WV SXE16VB680               |
| C52                     | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C53                     | 54-10-2750           | FXD ELECT 3900MF        | 10WV SXE10VB                  |
| C54                     | 54-10-2750           | FXD ELECT 3900MF        | 10WV SXE10VB                  |
| C55                     | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C56                     | 54-10-2750           | FXD ELECT 3900MF        | 10WV SXE10VB                  |
| C57                     | 54-10-2750           | FXD ELECT 3900MF        | 10WV SXE10VB                  |
| C58                     | 50-67-0020           | FXD PLSTC FILM 0.0047MF | 10% 100WV                     |
| C59                     | 54-10-2740           | FXD ELECT 820MF         | 10WV SXE10VB820               |
| C60                     | 54-10-2740           | FXD ELECT 820MF         | 10WV SXE10VB820               |
| C61                     | 55-37-2030           | FXD TANT ELECT 0.47MF   | 35V SXE10VB820                |
| C62                     | 54-10-2740           | FXD ELECT 820MF         | 10WV                          |
| C63                     | 52-77-1010           | FXD CER 1000PF          | 250VAC FOR UL & CSA           |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                | 97-11-0280 |            |
|-------------------------|----------------------|----------------------------|------------|------------|
| C104                    | 54-80-1110           | FXD ELECT 120MF 400WV      |            | KME400VNSN |
| C114                    | 54-30-2790           | FXD ELECT 82MF 35WV        |            | SXE35VB82  |
| C161                    | 54-30-1960           | FXD ELECT 47MF 25WV        |            |            |
| C173                    | 55-37-2050           | FXD TANT ELECT 1UF 35V     |            |            |
| CR1                     | 32-90-2281           | DIODE BRIGE VRM=600V IO=4A | TOSHIBA    | 4J4B41     |
| CR2                     | 32-90-0523           | DIODE VR=600V IO=1A        | TOSHIBA    | S5277J     |
| CR3                     | 32-92-0130           | ZENER VZ=12.4-13.1V P=0.4W | NEC        | RD13JB1    |
| CR4                     | 32-90-3050           | DIODE VR=800V IO=1A        | HITACHI    | DFG1C8     |
| CR5                     | 32-90-0550           | DIODE VR=1KV IO=1A         | HITACHI    | V11M       |
| CR6                     | 32-90-0550           | DIODE VR=1KV IO=1A         | HITACHI    | V11M       |
| CR7                     | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR8                     | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR9                     | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR10                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR11                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR12                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR13                    | 32-91-1805           | ZENER VZ=5.48-5.76V P=0.4W | NEC        | RD5.6JSB2  |
| CR14                    | 32-92-0062           | ZENER VZ=5.8 - 6.6V P=0.4W | NEC        | RD6.2JB    |
| CR15                    | 32-90-3050           | DIODE VR=800V IO=1A        | HITACHI    | DFG1C8     |
| CR16                    | 32-90-0550           | DIODE VR=1KV IO=1A         | HITACHI    | V11M       |
| CR17                    | 32-90-0550           | DIODE VR=1KV IO=1A         | HITACHI    | V11M       |
| CR18                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR19                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR20                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR21                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR22                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR23                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR24                    | 32-91-1805           | ZENER VZ=5.48-5.76V P=0.4W | NEC        | RD5.6JSB2  |
| CR30                    | 32-90-3050           | DIODE VR=800V IO=1A        | HITACHI    | DFG1C8     |
| CR31                    | 32-90-3050           | DIODE VR=800V IO=1A        | HITACHI    | DFG1C8     |
| CR32                    | 32-90-1843           | DIODE VR=200V IO=3A        | N.INTER    | 30DF2      |
| CR33                    | 32-90-1843           | DIODE VR=200V IO=3A        | N.INTER    | 30DF2      |
| CR34                    | 32-91-2300           | ZENER VZ=135 - 165V P=1W   | TOSHIBA    | 1Z150      |
| CR35                    | 32-92-0130           | ZENER VZ=12.4-13.1V P=0.4W | NEC        | RD13JB1    |
| CR36                    | 32-92-0130           | ZENER VZ=12.4-13.1V P=0.4W | NEC        | RD13JB1    |
| CR37                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR38                    | 32-92-0056           | ZENER VZ=5.5 - 5.8V P=0.4W | NEC        | RD5.6JB2   |
| CR39                    | 32-90-2970           | DIODE VR= 40V IO=1.7A      | SANKEN     | RK14       |
| CR40                    | 32-90-2420           | DIODE BRIGE VRM=40V IO=8A  | N.INTER    | C8P04Q     |
| CR41                    | 32-90-2980           | DIODE VR= 40V IO=5A        | NEC        | 5CS04SM    |
| CR42                    | 32-91-1805           | ZENER VZ=5.48-5.76V P=0.4W | NEC        | RD5.6JSB2  |
| CR43                    | 32-92-0100           | ZENER VZ=10.1-10.6V P=0.4W | NEC        | RD10JB3    |
| L10                     | 67-10-0890           | INDUCTOR 100MH 10%         |            |            |
| L11                     | 67-10-0890           | INDUCTOR 100MH 10%         |            |            |
| L12                     | 67-10-0890           | INDUCTOR 100MH 10%         |            |            |
| L13                     | 67-10-0890           | INDUCTOR 100MH 10%         |            |            |
| L14                     | 67-10-0921           | INDUCTOR 470UH 10%         |            | LAL04NA    |
| L15                     | 67-15-0320           | INDUCTOR 15UH 4.5A         |            | HP10D150M  |
| L16                     | 67-15-0320           | INDUCTOR 15UH 4.5A         |            | HP10D150M  |
| L114                    | 67-10-0921           | INDUCTOR 470UH 10%         |            | LAL04NA    |
| PC1                     | 37-30-0111           | PHOT COUPLER               | TOSHIBA    | TLP521-1BL |



| REFERENCE<br>SIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                 | 97-11-0280 |            |
|-----------------------|----------------------|-----------------------------|------------|------------|
| C2                    | 37-30-0111           | PHOT COUPLER                | TOSHIBA    | TLP521-1BL |
| C3                    | 37-30-0111           | PHOT COUPLER                | TOSHIBA    | TLP521-1BL |
| C4                    | 37-30-0111           | PHOT COUPLER                | TOSHIBA    | TLP521-1BL |
| 1                     | 30-31-8151           | TR SI NPN (50V 0.15A 0.4W)  | TOSHIBA    | 2SC1815-Y  |
| 2                     | 30-11-0151           | TR SI PNP                   | TOSHIBA    | 2SA1015-Y  |
| 3                     | 30-31-8461           | TR SI NPN                   | MATSUSITA  | 2SC1846-R  |
| 4                     | 30-33-5590           | TR SI NPN (800V 3A 40W)     | TOSHIBA    | 2SC3559    |
| 5                     | 30-33-5520           | TR SI NPN (1100V 12A 150W)  | SANYO      | 2SC3552    |
| 6                     | 30-31-1731           | TR SI NPN (30V 3A 10W )     | TOSHIBA    | 2SC1173-Y  |
| 7                     | 30-33-5590           | TR SI NPN (800V 3A 40W)     | TOSHIBA    | 2SC3559    |
| 8                     | 30-33-4610           | TR SI NPN (1100V 8A 140W)   | SANYO      | 2SC3461    |
| 9                     | 30-11-0151           | TR SI PNP                   | TOSHIBA    | 2SA1015-Y  |
| 10                    | 30-31-1731           | TR SI NPN (30V 3A 10W )     | TOSHIBA    | 2SC1173-Y  |
| 11                    | 30-21-0150           | TR SI PNP (60V 3A 25W)      | TOSHIBA    | 2SB1015-Y  |
| 12                    | 30-41-4060           | TR SI NPN (60V 3A 25W)      | TOSHIBA    | 2SD1406-Y  |
| 13                    | 30-41-4060           | TR SI NPN (60V 3A 25W)      | TOSHIBA    | 2SD1406-Y  |
| 14                    | 30-31-8151           | TR SI NPN (50V 0.15A 0.4W)  | TOSHIBA    | 2SC1815-Y  |
| 15                    | 30-31-8151           | TR SI NPN (50V 0.15A 0.4W)  | TOSHIBA    | 2SC1815-Y  |
| 16                    | 30-11-0151           | TR SI PNP                   | TOSHIBA    | 2SA1015-Y  |
| 1                     | 40-16-5101           | FXD C FILM 1M OHM 5% 1/6W   |            | RD1/6FS    |
| 2                     | 40-16-4471           | FXD C FILM 470K OHM 5% 1/6W |            | RD1/6FS    |
| 3                     | 40-16-2221           | FXD C FILM 2.2K OHM 5% 1/6W |            | RD1/6FS    |
| 4                     | 44-91-3684           | FXD M OXIDE 68K OHM 5% 1W   | MATSUSITA  | ERG1ANJ    |
| 5                     | 40-16-3151           | FXD C FILM 15K OHM 5% 1/6W  |            | RD1/6FS    |
| 6                     | 40-16-2221           | FXD C FILM 2.2K OHM 5% 1/6W |            | RD1/6FS    |
| 7                     | 40-16-2561           | FXD C FILM 5.6K OHM 5% 1/6W |            | RD1/6FS    |
| 8                     | 40-16-2221           | FXD C FILM 2.2K OHM 5% 1/6W |            | RD1/6FS    |
| 9                     | 40-37-4471           | FXD C FILM 470K OHM 5% 1/2W |            |            |
| 10                    | 44-57-0540           | FXD M OXIDE 100K OHM 5% 2W  | MATSUSITA  | ERG2SJ     |
| 11                    | 44-92-1474           | FXD M OXIDE 470 OHM 5% 2W   | MATSUSITA  | ERG2ANJ    |
| 12                    | 44-91-1334           | FXD M OXIDE 330 OHM 5% 1W   | MATSUSITA  | ERG1ANJ    |
| 13                    | 40-27-1472           | FXD C FILM 470 OHM 5% 1/4W  |            |            |
| 14                    | 42-83-0330           | FXD M FILM 33 OHM 1% 1/4W   |            |            |
| 15                    | 44-91-9224           | FXD M OXIDE 0.22 OHM 5% 1W  | MATSUSITA  | ERX1ANJ    |
| 16                    | 42-80-1681           | FXD M FILM 680 OHM 1% 1/6W  |            | RN1/6FS    |
| 17                    | 40-16-8561           | FXD C FILM 5.6 OHM 5% 1/6W  |            | RD1/6FS    |
| 18                    | 40-16-8561           | FXD C FILM 5.6 OHM 5% 1/6W  |            | RD1/6FS    |
| 19                    | 42-80-1331           | FXD M FILM 330 OHM 1% 1/6W  |            | RN1/6FS    |
| 20                    | 40-16-1101           | FXD C FILM 100 OHM 5% 1/6W  |            | RD1/6FS    |
| 21                    | 40-16-2101           | FXD C FILM 1K OHM 5% 1/6W   |            | RD1/6FS    |
| 22                    | 40-16-1471           | FXD C FILM 470 OHM 5% 1/6W  |            | RD1/6FS    |
| 23                    | 40-37-4471           | FXD C FILM 470K OHM 5% 1/2W |            |            |
| 24                    | 44-57-0540           | FXD M OXIDE 100K OHM 5% 2W  | MATSUSITA  | ERG2SJ     |
| 25                    | 44-92-1474           | FXD M OXIDE 470 OHM 5% 2W   | MATSUSITA  | ERG2ANJ    |
| 26                    | 44-91-1334           | FXD M OXIDE 330 OHM 5% 1W   | MATSUSITA  | ERG1ANJ    |
| 27                    | 40-16-1471           | FXD C FILM 470 OHM 5% 1/6W  |            | RD1/6FS    |
| 28                    | 42-80-0221           | FXD M FILM 22 OHM 1% 1/6W   |            | RN1/6FS    |
| 29                    | 44-91-9474           | FXD M OXIDE 0.47 OHM 5% 1W  | MATSUSITA  | ERX1ANJ    |
| 30                    | 42-80-1561           | FXD M FILM 560 OHM 1% 1/6W  |            | RN1/6FS    |
| 31                    | 40-16-8561           | FXD C FILM 5.6 OHM 5% 1/6W  |            | RD1/6FS    |
| 32                    | 42-80-1391           | FXD M FILM 390 OHM 1% 1/6W  |            | RN1/6FS    |
| 33                    | 40-16-1101           | FXD C FILM 100 OHM 5% 1/6W  |            | RD1/6FS    |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                  | 97-11-0280  |                   |
|-------------------------|----------------------|------------------------------|-------------|-------------------|
| R34                     | 40-16-2101           | FXD C FILM 1K                | OHM 5% 1/6W | RD1/6FS           |
| R35                     | 40-16-1471           | FXD C FILM 470               | OHM 5% 1/6W | RD1/6FS           |
| R42                     | 42-80-4151           | FXD M FILM 150K              | OHM 1% 1/6W | RN1/6FS           |
| R43                     | 42-80-2271           | FXD M FILM 2.7K              | OHM 1% 1/6W | RN1/6FS           |
| R44                     | 40-16-3101           | FXD C FILM 10K               | OHM 5% 1/6W | RD1/6FS           |
| R45                     | 40-16-1471           | FXD C FILM 470               | OHM 5% 1/6W | RD1/6FS           |
| R46                     | 40-16-2101           | FXD C FILM 1K                | OHM 5% 1/6W | RD1/6FS           |
| R49                     | 44-91-9564           | FXD M OXIDE 0.56             | OHM 5% 1W   | MATSUSITA ERX1ANJ |
| R50                     | 40-16-1151           | FXD C FILM 150               | OHM 5% 1/6W | RD1/6FS           |
| R51                     | 44-92-0334           | FXD M OXIDE 33               | OHM 5% 2W   | MATSUSITA ERG2ANJ |
| R52                     | 44-91-9564           | FXD M OXIDE 0.56             | OHM 5% 1W   | MATSUSITA ERX1ANJ |
| R53                     | 40-16-1151           | FXD C FILM 150               | OHM 5% 1/6W | RD1/6FS           |
| R54                     | 44-92-0151           | FXD M OXIDE 15               | OHM 5% 2W   | MATSUSITA ERG2ANJ |
| R55                     | 40-16-2561           | FXD C FILM 5.6K              | OHM 5% 1/6W | RD1/6FS           |
| R56                     | 40-16-2561           | FXD C FILM 5.6K              | OHM 5% 1/6W | RD1/6FS           |
| R57                     | 40-16-2561           | FXD C FILM 5.6K              | OHM 5% 1/6W | RD1/6FS           |
| R58                     | 42-80-2201           | FXD M FILM 2K                | OHM 1% 1/6W | RN1/6FS           |
| R59                     | 42-80-2201           | FXD M FILM 2K                | OHM 1% 1/6W | RN1/6FS           |
| R60                     | 40-16-2101           | FXD C FILM 1K                | OHM 5% 1/6W | RD1/6FS           |
| R61                     | 40-16-2101           | FXD C FILM 1K                | OHM 5% 1/6W | RD1/6FS           |
| R65                     | 40-16-1331           | FXD C FILM 330               | OHM 5% 1/6W | RD1/6FS           |
| R66                     | 40-16-2101           | FXD C FILM 1K                | OHM 5% 1/6W | RD1/6FS           |
| R67                     | 44-91-9824           | FXD M OXIDE 0.82             | OHM 5% 1W   | MATSUSITA ERX1ANJ |
| R68                     | 42-80-2101           | FXD M FILM 1K                | OHM 1% 1/6W | RN1/6FS           |
| R69                     | 42-80-2101           | FXD M FILM 1K                | OHM 1% 1/6W | RN1/6FS           |
| R70                     | 40-16-3221           | FXD C FILM 22K               | OHM 5% 1/6W | RD1/6FS           |
| R71                     | 40-27-0102           | FXD C FILM 10                | OHM 5% 1/4W | NAS1/4S           |
| R72                     | 40-27-0102           | FXD C FILM 10                | OHM 5% 1/4W | NAS1/4S           |
| R73                     | 42-80-2101           | FXD M FILM 1K                | OHM 1% 1/6W | RN1/6FS           |
| R74                     | 42-80-2101           | FXD M FILM 1K                | OHM 1% 1/6W | RN1/6FS           |
| R75                     | 40-16-3121           | FXD C FILM 12K               | OHM 5% 1/6W | RD1/6FS           |
| R76                     | 40-16-1471           | FXD C FILM 470               | OHM 5% 1/6W | RD1/6FS           |
| R77                     | 40-16-2101           | FXD C FILM 1K                | OHM 5% 1/6W | RD1/6FS           |
| R78                     | 40-16-2221           | FXD C FILM 2.2K              | OHM 5% 1/6W | RD1/6FS           |
| R79                     | 40-16-3221           | FXD C FILM 22K               | OHM 5% 1/6W | RD1/6FS           |
| R80                     | 40-16-0221           | FXD C FILM 22                | OHM 5% 1/6W | RD1/6FS           |
| R81                     | 40-16-2181           | FXD C FILM 1.8K              | OHM 5% 1/6W | RD1/6FS           |
| R82                     | 40-16-2221           | FXD C FILM 2.2K              | OHM 5% 1/6W | RD1/6FS           |
| R165                    | 40-16-1331           | FXD C FILM 330               | OHM 5% 1/6W | RD1/6FS           |
| R173                    | 40-16-1681           | FXD C FILM 680               | OHM 5% 1/6W | RD1/6FS           |
| RT1                     | 38-00-0120           | THERMISTOR                   |             | 8D13              |
| RV1                     | 48-31-2100           | VAR M GLAZE 1K               | OHM B PH    |                   |
| T1                      | 67-10-1760           | INDUCTOR 1MH                 | 2.5A        | SC-02-10A2        |
| T2                      | 63-94-2140           | SWITCHING TRANS T-4BL2 (BLK) | KIKUSUI     | S8513691          |
| T3                      | 63-94-2160           | SWITCHING TRANS T6-6G (GRN)  | KIKUSUI     | S8510481          |
| TS1                     | 82-91-0350           | THERMOSTAT UL                |             | 5003F90B4         |
| U1                      | 34-90-0051           | REGULATOR                    | TEXAS INS.  | TL431CLPB         |
| U2                      | 34-00-0240           | DUAL OPE-AMP                 | NEC         | UPC4558C          |
| U3                      | 34-90-0051           | REGULATOR                    | TEXAS INS.  | TL431CLPB         |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION           | 97-11-0280          |
|-------------------------|----------------------|-----------------------|---------------------|
| U4                      | 34-90-0051           | REGULATOR             | TEXAS INS.TL431CLPB |
| VR1                     | 39-00-0410           | SURGE ABSORBER (430V) | MATSUSITA ERZC07DK  |

|              |            |
|--------------|------------|
| A13 ASSEMBLY | 97-11-0250 |
|--------------|------------|

|    |            |            |       |             |
|----|------------|------------|-------|-------------|
| C1 | 54-30-1970 | FXD ELECT  | 100MF | 25WV        |
| R1 | 40-37-0331 | FXD C FILM | 33    | OHM 5% 1/2W |

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0121

A14 ASSEMBLY

|      |            |                       |               |        |           |                       |
|------|------------|-----------------------|---------------|--------|-----------|-----------------------|
| BT1  | 94-00-0210 | BATTERY               | 3.0V 38MAH    | LITHUM |           | BR1225-IVD            |
| C1   | 52-48-1050 | FXD CER               | 0.1UF         | 20%    | 25V       | D33Y5V1E              |
| C2   | 52-01-2345 | FXD CER               | 1000PF        | 10%    | 50V TYPE2 |                       |
| C4   | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C5   | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C6   | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C7   | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C8   | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C10  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C11  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C12  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C13  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C14  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C15  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C16  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C17  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C18  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C19  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C20  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C21  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C22  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C23  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C24  | 52-37-1000 | FXD CER               | 0.047UF       | 20%    | 25V TYPE1 |                       |
| C25  | 54-30-1960 | FXD ELECT             | 47MF          |        | 25WV      |                       |
| C26  | 54-30-1960 | FXD ELECT             | 47MF          |        | 25WV      |                       |
| CR1  | 32-92-0027 | ZENER                 | VZ=2.5 - 2.8V |        |           | HITACHI HZS-2.7EB1    |
| CR2  | 32-30-1200 | DIODE                 | VR=60V IO=1A  |        |           | HITACHI 1SS120        |
| CR3  | 32-30-1200 | DIODE                 | VR=60V IO=1A  |        |           | HITACHI 1SS120        |
| CR4  | 32-30-1200 | DIODE                 | VR=60V IO=1A  |        |           | HITACHI 1SS120        |
| Q1   | 30-32-1201 | TR SI NPN             |               |        |           | TOSHIBA 2SC2120-Y     |
| R1   | 40-16-3101 | FXD C FILM            | 10K           | OHM 5% | 1/6W      | RD1/6FS               |
| R2   | 40-16-3101 | FXD C FILM            | 10K           | OHM 5% | 1/6W      | RD1/6FS               |
| R3   | 40-16-2101 | FXD C FILM            | 1K            | OHM 5% | 1/6W      | RD1/6FS               |
| R5   | 40-16-3101 | FXD C FILM            | 10K           | OHM 5% | 1/6W      | RD1/6FS               |
| R6   | 40-16-2331 | FXD C FILM            | 3.3K          | OHM 5% | 1/6W      | RD1/6FS               |
| RA1  | 44-08-0010 | FXD M GLAZE           | R-NET 10K     | OHM X8 |           | TNA09A103J            |
| RA2  | 44-08-0010 | FXD M GLAZE           | R-NET 10K     | OHM X8 |           | TNA09A103J            |
| RA3  | 44-07-0070 | FXD M GLAZE           | R-NET 3.3K    | OHM X8 |           |                       |
| RA4  | 44-07-0070 | FXD M GLAZE           | R-NET 3.3K    | OHM X8 |           |                       |
| U1A  | 35-53-5414 | OCTAL BUFFER          |               |        |           | TEXAS INS. SN7HCS541N |
| U1B  | 35-53-2454 | OCTAL BUS TRANSCEIVER |               |        |           | TOSHIBA TC74HC245P    |
| U1C  | 35-53-5414 | OCTAL BUFFER          |               |        |           | TEXAS INS. SN7HCS541N |
| U1D  | 35-53-5414 | OCTAL BUFFER          |               |        |           | TEXAS INS. SN7HCS541N |
| U10D | 35-07-0040 | S-RAM                 | 8K X 8BIT     | 150NS  |           | HITACHI HM6264LP-     |

| REFERENCE<br>SIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                   | 97-11-0121            |
|-----------------------|----------------------|-------------------------------|-----------------------|
| 11A                   | 35-70-1386           | 3LINE TO 8LINE DECORDER       | HITACHI HD74HC138P    |
| 11B                   | 35-53-1334           | 13-INPUT POSITIVE-NAND GATES  | TOSHIBA TC74HC133P    |
| 11C                   | 35-70-1386           | 3LINE TO 8LINE DECORDER       | HITACHI HD74HC138P    |
| 11D                   | 35-07-0060           | S-RAM 8K X 8BIT 150NS         | TOSHIBA TC5564LP-     |
| 12A                   | 35-70-2991           | 8 BIT SHIFT RESISTER          | TEXAS INS. SN74LS299N |
| 12B                   | 35-53-3674           | HEX BUS DRIVERS               | TOSHIBA TC74HC367P    |
| 12C                   | 35-53-0304           | 8-INPUT POSI-NAND GATE        | TOSIHBA TC74HC30P     |
| 12D                   | 35-53-5414           | OCTAL BUFFER                  | TEXAS INS. SN7HCS541N |
| 13A                   | 35-70-0060           | HEX INVERTER BUFFERS/DRIVERS  | TEXAS INS. SN7406N    |
| 13B                   | 35-53-0144           | HEX SHMITT-TRIG INVERTER      | TOSHIBA TC74HC14P     |
| 14A                   | 35-70-0746           | DUAL D F-F EDGE TRIGGER       | TOSHIBA TC74HC74P     |
| 14B                   | 35-70-0326           | QUAD 2-INPUT POSI-OR          | TOSHIBA TC74HC32P     |
| 14D                   | 35-01-0000           | Z80A-CPU 4MHZ (CMOS)          | NEC UPD70008C         |
| 15A                   | 35-53-1744           | HEX D-TYPE FLIP FLOP          | TOSHIBA TC74HC174P    |
| 15B                   | 36-90-0230           | GP-IB DATA TRANSCEIVER        | TEXAS INS. SN75160AN  |
| 16A                   | 35-53-0144           | HEX SHMITT-TRIG INVERTER      | TOSHIBA TC74HC14P     |
| 16B                   | 36-90-0240           | GP-IB CONTROL INTERFACE       | TEXAS INS. SN75161AN  |
| 16C                   | 36-90-0220           | GP-IB (IEEE-488) ADAPTOR      | TEXAS INS. TMS9914ANL |
| 16D                   | 36-90-0130           | Z80-DMA 4MHZ                  | SHARP LH0083A         |
| 17D                   | 35-05-0010           | EPROM 32K X 8BIT 250NS (CMOS) | 27C256                |
| 18A                   | 35-53-2454           | OCTAL BUS TRANSCEIVER         | TOSHIBA TC74HC245P    |
| 18B                   | 35-70-0086           | QUAD 2-INPUT POSI-AND         | TOSHIBA TC74HC08P     |
| 18C                   | 35-70-0326           | QUAD 2-INPUT POSI-OR          | TOSHIBA TC74HC32P     |
| 18D                   | 35-05-0010           | EPROM 32K X 8BIT 250NS (CMOS) | 27C256                |
| 19A                   | 35-70-0326           | QUAD 2-INPUT POSI-OR          | TOSHIBA TC74HC32P     |
| 19B                   | 35-70-0006           | QUAD 2-INPUT POSI-NAND        | TOSHIBA TC74HC00P     |
| 19C                   | 35-70-1396           | 2LINE TO 4LINE DECORDER       | TOSHIBA TC74HC139P    |
| 19D                   | 35-07-0040           | S-RAM 8K X 8BIT 150NS         | HITACHI HM6264LP-     |



REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0170

A15 ASSEMBLY

|     |            |           |            |             |             |
|-----|------------|-----------|------------|-------------|-------------|
| C1  | 56-48-1000 | FXD CER   | EMI FILTER |             |             |
| C2  | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C3  | 52-05-2468 | FXD CER   | 0.01UF     | +80-20% 50V | TYPE2       |
| C4  | 52-01-2385 | FXD CER   | 2200PF     | 10%         | 50V TYPE2   |
| C6  | 56-48-1000 | FXD CER   | EMI FILTER |             |             |
| C7  | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C8  | 52-05-2468 | FXD CER   | 0.01UF     | +80-20% 50V | TYPE2       |
| C9  | 52-01-2385 | FXD CER   | 2200PF     | 10%         | 50V TYPE2   |
| C11 | 56-48-1000 | FXD CER   | EMI FILTER |             |             |
| C12 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C13 | 56-48-1000 | FXD CER   | EMI FILTER |             |             |
| C14 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C15 | 52-05-2468 | FXD CER   | 0.01UF     | +80-20% 50V | TYPE2       |
| C16 | 52-05-2468 | FXD CER   | 0.01UF     | +80-20% 50V | TYPE2       |
| C17 | 52-05-2468 | FXD CER   | 0.01UF     | +80-20% 50V | TYPE2       |
| C18 | 52-05-2468 | FXD CER   | 0.01UF     | +80-20% 50V | TYPE2       |
| C19 | 52-06-2145 | FXD CER   | 22PF       | 10% 500V    | TYPE1       |
| C20 | 52-06-2145 | FXD CER   | 22PF       | 10% 500V    | TYPE1       |
| C21 | 52-05-2468 | FXD CER   | 0.01UF     | +80-20% 50V | TYPE2       |
| C22 | 52-05-2468 | FXD CER   | 0.01UF     | +80-20% 50V | TYPE2       |
| C23 | 52-06-2145 | FXD CER   | 22PF       | 10% 500V    | TYPE1       |
| C24 | 52-06-2145 | FXD CER   | 22PF       | 10% 500V    | TYPE1       |
| C27 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C28 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C29 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C30 | 52-37-1000 | FXD CER   | 0.047UF    | 20% 25V     | TYPE1       |
| C31 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C32 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C33 | 52-37-1000 | FXD CER   | 0.047UF    | 20% 25V     | TYPE1       |
| C34 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C35 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C36 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C37 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C38 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C39 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C40 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C41 | 52-06-2145 | FXD CER   | 22PF       | 10% 500V    | TYPE1       |
| C42 | 52-06-2145 | FXD CER   | 22PF       | 10% 500V    | TYPE1       |
| C49 | 54-40-1200 | FXD ELECT | 10MF       | 50WV        |             |
| C50 | 57-10-1202 | VAR CER   | 5-20PF     |             | ALPS CTZ53E |
| C51 | 57-10-1202 | VAR CER   | 5-20PF     |             | ALPS CTZ53E |
| C53 | 52-06-2274 | FXD CER   | 270P       | 10% 50V     | TYPE1       |
| C54 | 54-10-2590 | FXD ELECT | 100MF      | 10WV        |             |
| C57 | 57-10-1202 | VAR CER   | 5-20PF     |             | ALPS CTZ53E |
| C58 | 57-10-1202 | VAR CER   | 5-20PF     |             | ALPS CTZ53E |
| C60 | 54-10-2590 | FXD ELECT | 100MF      | 10WV        |             |
| C61 | 52-06-2274 | FXD CER   | 270P       | 10% 50V     | TYPE1       |
| C64 | 52-06-2165 | FXD CER   | 33PF       | 10% 500V    | TYPE1       |
| C65 | 52-06-2165 | FXD CER   | 33PF       | 10% 500V    | TYPE1       |
| C66 | 52-06-2125 | FXD CER   | 15PF       | 10% 500V    | TYPE1       |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION           | 97-11-0170     |         |           |
|-------------------------|----------------------|-----------------------|----------------|---------|-----------|
| C67                     | 52-06-2125           | FXD CER 15PF          | 10% 500V TYPE1 |         |           |
| C68                     | 52-06-2125           | FXD CER 15PF          | 10% 500V TYPE1 |         |           |
| C69                     | 52-06-2125           | FXD CER 15PF          | 10% 500V TYPE1 |         |           |
| C72                     | 52-06-2215           | FXD CER 82PF          | 10% 500V TYPE1 |         |           |
| C73                     | 52-06-2215           | FXD CER 82PF          | 10% 500V TYPE1 |         |           |
| CR1                     | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR2                     | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR3                     | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR4                     | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR5                     | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR6                     | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR7                     | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR8                     | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR11                    | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| CR12                    | 32-99-0000           | DIODE VAR,CAP         |                | TOSHIBA | 1SV101    |
| CR13                    | 32-99-0000           | DIODE VAR,CAP         |                | TOSHIBA | 1SV101    |
| CR14                    | 32-99-0000           | DIODE VAR,CAP         |                | TOSHIBA | 1SV101    |
| CR15                    | 32-99-0000           | DIODE VAR,CAP         |                | TOSHIBA | 1SV101    |
| CR16                    | 32-30-1200           | DIODE VR=60V          | IO=1A          | HITACHI | 1SS120    |
| Q1                      | 30-32-1201           | TR SI NPN             |                | TOSHIBA | 2SC2120-Y |
| Q2                      | 30-10-9501           | TR SI PNP HFE=160-320 |                | TOSHIBA | 2SA950-Y  |
| Q3                      | 30-11-0151           | TR SI PNP             |                | TOSHIBA | 2SA1015-Y |
| Q4                      | 30-11-0151           | TR SI PNP             |                | TOSHIBA | 2SA1015-Y |
| Q5                      | 30-32-5700           | TR SI NPN             |                | NEC     | 2SC2570   |
| Q6                      | 30-32-5700           | TR SI NPN             |                | NEC     | 2SC2570   |
| Q7                      | 30-32-5700           | TR SI NPN             |                | NEC     | 2SC2570   |
| Q8                      | 30-32-5700           | TR SI NPN             |                | NEC     | 2SC2570   |
| Q9                      | 30-31-9071           | TR SI NPN             |                | HITACHI | 2SC1907   |
| Q10                     | 30-31-9071           | TR SI NPN             |                | HITACHI | 2SC1907   |
| Q13                     | 30-11-0151           | TR SI PNP             |                | TOSHIBA | 2SA1015-Y |
| R1                      | 40-16-1681           | FXD C FILM 680        | OHM 5% 1/6W    |         | RD1/6FS   |
| R2                      | 42-80-2151           | FXD M FILM 1.5K       | OHM 1% 1/6W    |         | RN1/6FS   |
| R3                      | 42-80-2181           | FXD M FILM 1.8K       | OHM 1% 1/6W    |         | RN1/6FS   |
| R4                      | 40-16-1221           | FXD C FILM 220        | OHM 5% 1/6W    |         | RD1/6FS   |
| R5                      | 40-16-1681           | FXD C FILM 680        | OHM 5% 1/6W    |         | RD1/6FS   |
| R6                      | 40-16-3121           | FXD C FILM 12K        | OHM 5% 1/6W    |         | RD1/6FS   |
| R7                      | 42-80-2181           | FXD M FILM 1.8K       | OHM 1% 1/6W    |         | RN1/6FS   |
| R8                      | 42-80-2101           | FXD M FILM 1K         | OHM 1% 1/6W    |         | RN1/6FS   |
| R9                      | 40-16-0561           | FXD C FILM 56         | OHM 5% 1/6W    |         | RD1/6FS   |
| R10                     | 40-16-0561           | FXD C FILM 56         | OHM 5% 1/6W    |         | RD1/6FS   |
| R11                     | 40-16-0561           | FXD C FILM 56         | OHM 5% 1/6W    |         | RD1/6FS   |
| R12                     | 40-16-0561           | FXD C FILM 56         | OHM 5% 1/6W    |         | RD1/6FS   |
| R13                     | 40-16-2561           | FXD C FILM 5.6K       | OHM 5% 1/6W    |         | RD1/6FS   |
| R14                     | 40-16-2101           | FXD C FILM 1K         | OHM 5% 1/6W    |         | RD1/6FS   |
| R15                     | 40-16-2561           | FXD C FILM 5.6K       | OHM 5% 1/6W    |         | RD1/6FS   |
| R16                     | 40-16-2101           | FXD C FILM 1K         | OHM 5% 1/6W    |         | RD1/6FS   |
| R17                     | 40-16-1471           | FXD C FILM 470        | OHM 5% 1/6W    |         | RD1/6FS   |
| R18                     | 40-16-1471           | FXD C FILM 470        | OHM 5% 1/6W    |         | RD1/6FS   |
| R19                     | 40-16-1101           | FXD C FILM 100        | OHM 5% 1/6W    |         | RD1/6FS   |
| R20                     | 40-16-1101           | FXD C FILM 100        | OHM 5% 1/6W    |         | RD1/6FS   |
| R21                     | 40-16-1101           | FXD C FILM 100        | OHM 5% 1/6W    |         | RD1/6FS   |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION |   |       | 97-11-0170 |             |                |
|-------------------------|----------------------|-------------|---|-------|------------|-------------|----------------|
| R22                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R23                     | 40-16-1681           | FXD         | C | FILM  | 680        | OHM 5% 1/6W | RD1/6FS        |
| R24                     | 40-16-1681           | FXD         | C | FILM  | 680        | OHM 5% 1/6W | RD1/6FS        |
| R25                     | 40-16-1681           | FXD         | C | FILM  | 680        | OHM 5% 1/6W | RD1/6FS        |
| R26                     | 40-16-1681           | FXD         | C | FILM  | 680        | OHM 5% 1/6W | RD1/6FS        |
| R27                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R28                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R29                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R30                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R31                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R32                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R37                     | 40-16-1181           | FXD         | C | FILM  | 180        | OHM 5% 1/6W | RD1/6FS        |
| R38                     | 40-16-1181           | FXD         | C | FILM  | 180        | OHM 5% 1/6W | RD1/6FS        |
| R41                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R42                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R43                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R44                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R47                     | 40-16-0821           | FXD         | C | FILM  | 82         | OHM 5% 1/6W | RD1/6FS        |
| R48                     | 40-16-2101           | FXD         | C | FILM  | 1K         | OHM 5% 1/6W | RD1/6FS        |
| R49                     | 40-16-1561           | FXD         | C | FILM  | 560        | OHM 5% 1/6W | RD1/6FS        |
| R50                     | 40-16-0821           | FXD         | C | FILM  | 82         | OHM 5% 1/6W | RD1/6FS        |
| R51                     | 42-80-0471           | FXD         | M | FILM  | 47         | OHM 1% 1/6W | RN1/6FS        |
| R52                     | 42-80-0471           | FXD         | M | FILM  | 47         | OHM 1% 1/6W | RN1/6FS        |
| R53                     | 42-80-0471           | FXD         | M | FILM  | 47         | OHM 1% 1/6W | RN1/6FS        |
| R54                     | 42-80-0471           | FXD         | M | FILM  | 47         | OHM 1% 1/6W | RN1/6FS        |
| R55                     | 40-16-0471           | FXD         | C | FILM  | 47         | OHM 5% 1/6W | RD1/6FS        |
| R56                     | 40-16-0471           | FXD         | C | FILM  | 47         | OHM 5% 1/6W | RD1/6FS        |
| R57                     | 40-16-0471           | FXD         | C | FILM  | 47         | OHM 5% 1/6W | RD1/6FS        |
| R58                     | 40-16-0471           | FXD         | C | FILM  | 47         | OHM 5% 1/6W | RD1/6FS        |
| R59                     | 40-16-0471           | FXD         | C | FILM  | 47         | OHM 5% 1/6W | RD1/6FS        |
| R60                     | 40-16-0471           | FXD         | C | FILM  | 47         | OHM 5% 1/6W | RD1/6FS        |
| R61                     | 40-16-0471           | FXD         | C | FILM  | 47         | OHM 5% 1/6W | RD1/6FS        |
| R62                     | 40-16-0471           | FXD         | C | FILM  | 47         | OHM 5% 1/6W | RD1/6FS        |
| R67                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R68                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R69                     | 40-16-1271           | FXD         | C | FILM  | 270        | OHM 5% 1/6W | RD1/6FS        |
| R70                     | 40-16-1101           | FXD         | C | FILM  | 100        | OHM 5% 1/6W | RD1/6FS        |
| R71                     | 40-16-1271           | FXD         | C | FILM  | 270        | OHM 5% 1/6W | RD1/6FS        |
| R72                     | 40-16-2821           | FXD         | C | FILM  | 8.2K       | OHM 5% 1/6W | RD1/6FS        |
| R73                     | 40-16-2681           | FXD         | C | FILM  | 6.8K       | OHM 5% 1/6W | RD1/6FS        |
| R74                     | 40-16-1271           | FXD         | C | FILM  | 270        | OHM 5% 1/6W | RD1/6FS        |
| R75                     | 40-16-2681           | FXD         | C | FILM  | 6.8K       | OHM 5% 1/6W | RD1/6FS        |
| R76                     | 40-16-2821           | FXD         | C | FILM  | 8.2K       | OHM 5% 1/6W | RD1/6FS        |
| R80                     | 40-16-4221           | FXD         | C | FILM  | 220K       | OHM 5% 1/6W | RD1/6FS        |
| R81                     | 40-16-4221           | FXD         | C | FILM  | 220K       | OHM 5% 1/6W | RD1/6FS        |
| R82                     | 40-16-4221           | FXD         | C | FILM  | 220K       | OHM 5% 1/6W | RD1/6FS        |
| R83                     | 40-16-4221           | FXD         | C | FILM  | 220K       | OHM 5% 1/6W | RD1/6FS        |
| R84                     | 40-16-1821           | FXD         | C | FILM  | 820        | OHM 5% 1/6W | RD1/6FS        |
| R85                     | 40-16-2101           | FXD         | C | FILM  | 1K         | OHM 5% 1/6W | RD1/6FS        |
| R86                     | 38-00-0080           | THERMISTOR  |   |       | 2500       | OHM         | TOSHIBA D33A   |
| R89                     | 40-16-1821           | FXD         | C | FILM  | 820        | OHM 5% 1/6W | RD1/6FS        |
| R90                     | 40-16-1821           | FXD         | C | FILM  | 820        | OHM 5% 1/6W | RD1/6FS        |
| RV1                     | 48-37-2100           | VAR         | M | GLAZE | 1K         | OHM B       | TEITSU VM5CKPV |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                     | 97-11-0170 |        |            |
|-------------------------|----------------------|---------------------------------|------------|--------|------------|
| RV2                     | 48-37-2100           | VAR M GLAZE 1K                  | OHM B      | TEITSU | VM5CKPV    |
| RV3                     | 48-37-2100           | VAR M GLAZE 1K                  | OHM B      | TEITSU | VM5CKPV    |
| RV4                     | 48-37-2100           | VAR M GLAZE 1K                  | OHM B      | TEITSU | VM5CKPV    |
| RV5                     | 48-37-2100           | VAR M GLAZE 1K                  | OHM B      | TEITSU | VM5CKPV    |
| RV6                     | 48-37-2100           | VAR M GLAZE 1K                  | OHM B      | TEITSU | VM5CKPV    |
| RV7                     | 48-31-1100           | VAR M GLAZE 100                 | OHM B PH   |        |            |
| RV8                     | 48-31-1100           | VAR M GLAZE 100                 | OHM B PH   |        |            |
| U1                      | 34-40-0430           | ADJUSTABLE SHUNT REGULATOR      |            |        | NJM431L    |
| U2                      | 34-40-0430           | ADJUSTABLE SHUNT REGULATOR      |            |        | NJM431L    |
| U3                      | 35-53-1584           | QUAD 2-TO-1 DATA SELECTOR (INV) | TOSHIBA    |        | TC74HC158P |
| U4                      | 35-70-0006           | QUAD 2-INPUT POSI-NAND          | TOSHIBA    |        | TC74HC00P  |
| U5                      | 36-00-1120           | HIC (H12 ST SIGNAL DRIVER)      | KIKUSUI    |        | B0909/9    |
| U6                      | 36-00-1130           | HIC (H13 CHANNEL DRIVER)        | KIKUSUI    |        | B1009/4    |
| U7                      | 36-00-1160           | HIC (H16 ENV PEAK HOLD)         | KIKUSUI    |        | B1309/4    |
| U8                      | 36-00-1160           | HIC (H16 ENV PEAK HOLD)         | KIKUSUI    |        | B1309/4    |



|            |           |             |            |
|------------|-----------|-------------|------------|
| REFERENCE  | KIKUSUI   |             |            |
| DESIGNATOR | PARTS NO. | DESCRIPTION | 97-11-0150 |

# A16 ASSEMBLY

|     |            |                    |                   |          |
|-----|------------|--------------------|-------------------|----------|
| C1  | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C2  | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C3  | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C4  | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C5  | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C6  | 56-48-1000 | FXD CER EMI FILTER |                   |          |
| C7  | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C8  | 52-01-2385 | FXD CER 2200PF     | 10% 50V TYPE2     |          |
| C9  | 52-05-2468 | FXD CER 0.01UF     | +80-20% 50V TYPE2 |          |
| C10 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C11 | 56-48-1000 | FXD CER EMI FILTER |                   |          |
| C12 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C13 | 52-01-2385 | FXD CER 2200PF     | 10% 50V TYPE2     |          |
| C14 | 52-05-2468 | FXD CER 0.01UF     | +80-20% 50V TYPE2 |          |
| C15 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C16 | 56-48-1000 | FXD CER EMI FILTER |                   |          |
| C17 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C18 | 56-48-1000 | FXD CER EMI FILTER |                   |          |
| C19 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C20 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C21 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C22 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C23 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C24 | 54-09-2000 | FXD ELECT 1000MF   | 6.3WV             | KME      |
| C25 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C26 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C27 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C28 | 54-40-1200 | FXD ELECT 10MF     | 50WV              |          |
| C29 | 54-09-2000 | FXD ELECT 1000MF   | 6.3WV             | KME      |
| C30 | 52-06-2215 | FXD CER 82PF       | 10% 500V TYPE1    |          |
| C31 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C32 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C33 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C34 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C35 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C36 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C37 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C38 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C39 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C40 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C41 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C42 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C43 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C44 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C45 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C46 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C47 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C48 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C49 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |
| C50 | 52-48-1050 | FXD CER 0.1UF      | 20% 25V           | D33Y5V1E |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION              | 97-11-0150    |         |            |
|-------------------------|----------------------|--------------------------|---------------|---------|------------|
| C51                     | 52-48-1050           | FXD CER 0.1UF            | 20% 25V       |         | D33Y5V1E   |
| C52                     | 52-48-1050           | FXD CER 0.1UF            | 20% 25V       |         | D33Y5V1E   |
| C53                     | 54-30-1960           | FXD ELECT 47MF           | 25WV          |         |            |
| C54                     | 54-40-1200           | FXD ELECT 10MF           | 50WV          |         |            |
| C55                     | 54-40-1200           | FXD ELECT 10MF           | 50WV          |         |            |
| C58                     | 52-01-2325           | FXD CER 680PF            | 10% 50V TYPE2 |         |            |
| C59                     | 52-06-2204           | FXD CER 68P              | 10% 50V TYPE1 |         |            |
| C60                     | 52-06-2204           | FXD CER 68P              | 10% 50V TYPE1 |         |            |
| C61                     | 52-06-2204           | FXD CER 68P              | 10% 50V TYPE1 |         |            |
| CR1                     | 32-92-0027           | ZENER VZ=2.5 - 2.8V      |               | HITACHI | HZS-2.7EB1 |
| CR2                     | 32-30-1200           | DIODE VR=60V IO=1A       |               | HITACHI | 1SS120     |
| DL1                     | 91-90-0007           | DELAY LINE 200 OHM 50NS  |               |         |            |
| DL2                     | 91-90-0007           | DELAY LINE 200 OHM 50NS  |               |         |            |
| Q1                      | 30-11-2061           | TR SI PNP                |               | NEC     | 2SA1206-L  |
| Q2                      | 30-11-2061           | TR SI PNP                |               | NEC     | 2SA1206-L  |
| Q3                      | 30-11-2061           | TR SI PNP                |               | NEC     | 2SA1206-L  |
| Q4                      | 30-11-2061           | TR SI PNP                |               | NEC     | 2SA1206-L  |
| Q5                      | 30-33-2791           | TR SI NPN (10V 2A 750MW) |               | TOSHIBA | 2SC3279L   |
| Q6                      | 30-11-3001           | TR SI PNP (10V 2A 750MW) |               | TOSHIBA | 2SA1300Y   |
| Q7                      | 31-20-1701           | FET                      |               | TOSHIBA | 2SK170-V   |
| Q8                      | 30-10-8441           | TR SI PNP                |               | HITACHI | 2SA844-D   |
| Q9                      | 30-10-8441           | TR SI PNP                |               | HITACHI | 2SA844-D   |
| Q10                     | 31-20-1701           | FET                      |               | TOSHIBA | 2SK170-V   |
| Q11                     | 30-11-0151           | TR SI PNP                |               | TOSHIBA | 2SA1015-Y  |
| Q12                     | 30-30-9451           | TR SI NPN                |               | NEC     | 2SC945-Q   |
| R1                      | 40-16-0471           | FXD C FILM 47            | OHM 5% 1/6W   |         | RD1/6FS    |
| R2                      | 42-80-1331           | FXD M FILM 330           | OHM 1% 1/6W   |         | RN1/6FS    |
| R3                      | 40-16-1561           | FXD C FILM 560           | OHM 5% 1/6W   |         | RD1/6FS    |
| R4                      | 40-16-1561           | FXD C FILM 560           | OHM 5% 1/6W   |         | RD1/6FS    |
| R5                      | 42-80-1331           | FXD M FILM 330           | OHM 1% 1/6W   |         | RN1/6FS    |
| R6                      | 40-16-1221           | FXD C FILM 220           | OHM 5% 1/6W   |         | RD1/6FS    |
| R7                      | 40-16-1221           | FXD C FILM 220           | OHM 5% 1/6W   |         | RD1/6FS    |
| R8                      | 40-16-0471           | FXD C FILM 47            | OHM 5% 1/6W   |         | RD1/6FS    |
| R9                      | 40-16-1331           | FXD C FILM 330           | OHM 5% 1/6W   |         | RD1/6FS    |
| R10                     | 40-16-0471           | FXD C FILM 47            | OHM 5% 1/6W   |         | RD1/6FS    |
| R11                     | 42-80-1331           | FXD M FILM 330           | OHM 1% 1/6W   |         | RN1/6FS    |
| R12                     | 40-16-1561           | FXD C FILM 560           | OHM 5% 1/6W   |         | RD1/6FS    |
| R13                     | 40-16-1561           | FXD C FILM 560           | OHM 5% 1/6W   |         | RD1/6FS    |
| R14                     | 42-80-1331           | FXD M FILM 330           | OHM 1% 1/6W   |         | RN1/6FS    |
| R15                     | 40-16-1221           | FXD C FILM 220           | OHM 5% 1/6W   |         | RD1/6FS    |
| R16                     | 40-16-1221           | FXD C FILM 220           | OHM 5% 1/6W   |         | RD1/6FS    |
| R17                     | 40-16-0471           | FXD C FILM 47            | OHM 5% 1/6W   |         | RD1/6FS    |
| R18                     | 40-16-1331           | FXD C FILM 330           | OHM 5% 1/6W   |         | RD1/6FS    |
| R19                     | 40-16-1331           | FXD C FILM 330           | OHM 5% 1/6W   |         | RD1/6FS    |
| R20                     | 40-16-1331           | FXD C FILM 330           | OHM 5% 1/6W   |         | RD1/6FS    |
| R21                     | 40-16-1681           | FXD C FILM 680           | OHM 5% 1/6W   |         | RD1/6FS    |
| R22                     | 42-80-2151           | FXD M FILM 1.5K          | OHM 1% 1/6W   |         | RN1/6FS    |
| R23                     | 42-80-2181           | FXD M FILM 1.8K          | OHM 1% 1/6W   |         | RN1/6FS    |
| R24                     | 40-16-1681           | FXD C FILM 680           | OHM 5% 1/6W   |         | RD1/6FS    |
| R25                     | 40-16-1221           | FXD C FILM 220           | OHM 5% 1/6W   |         | RD1/6FS    |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                  | 97-11-0150 |    |      |              |
|-------------------------|----------------------|------------------------------|------------|----|------|--------------|
| R26                     | 40-16-3221           | FXD C FILM 22K               | OHM        | 5% | 1/6W | RD1/6FS      |
| R27                     | 42-80-2181           | FXD M FILM 1.8K              | OHM        | 1% | 1/6W | RN1/6FS      |
| R28                     | 42-80-2101           | FXD M FILM 1K                | OHM        | 1% | 1/6W | RN1/6FS      |
| R29                     | 40-16-1681           | FXD C FILM 680               | OHM        | 5% | 1/6W | RD1/6FS      |
| R30                     | 40-16-3561           | FXD C FILM 56K               | OHM        | 5% | 1/6W | RD1/6FS      |
| R31                     | 40-16-2101           | FXD C FILM 1K                | OHM        | 5% | 1/6W | RD1/6FS      |
| R32                     | 40-16-1681           | FXD C FILM 680               | OHM        | 5% | 1/6W | RD1/6FS      |
| R33                     | 40-16-1561           | FXD C FILM 560               | OHM        | 5% | 1/6W | RD1/6FS      |
| R34                     | 40-16-1681           | FXD C FILM 680               | OHM        | 5% | 1/6W | RD1/6FS      |
| R35                     | 40-16-1821           | FXD C FILM 820               | OHM        | 5% | 1/6W | RD1/6FS      |
| R36                     | 40-16-1821           | FXD C FILM 820               | OHM        | 5% | 1/6W | RD1/6FS      |
| R37                     | 40-16-2221           | FXD C FILM 2.2K              | OHM        | 5% | 1/6W | RD1/6FS      |
| R38                     | 40-16-1331           | FXD C FILM 330               | OHM        | 5% | 1/6W | RD1/6FS      |
| R39                     | 40-16-2221           | FXD C FILM 2.2K              | OHM        | 5% | 1/6W | RD1/6FS      |
| R40                     | 40-16-1331           | FXD C FILM 330               | OHM        | 5% | 1/6W | RD1/6FS      |
| R41                     | 40-16-1331           | FXD C FILM 330               | OHM        | 5% | 1/6W | RD1/6FS      |
| R42                     | 40-16-1471           | FXD C FILM 470               | OHM        | 5% | 1/6W | RD1/6FS      |
| R43                     | 40-16-0471           | FXD C FILM 47                | OHM        | 5% | 1/6W | RD1/6FS      |
| R44                     | 42-80-1331           | FXD M FILM 330               | OHM        | 1% | 1/6W | RN1/6FS      |
| R45                     | 42-80-1471           | FXD M FILM 470               | OHM        | 1% | 1/6W | RN1/6FS      |
| R46                     | 40-16-0221           | FXD C FILM 22                | OHM        | 5% | 1/6W | RD1/6FS      |
| R47                     | 40-16-0471           | FXD C FILM 47                | OHM        | 5% | 1/6W | RD1/6FS      |
| R48                     | 42-80-1331           | FXD M FILM 330               | OHM        | 1% | 1/6W | RN1/6FS      |
| R49                     | 42-80-1471           | FXD M FILM 470               | OHM        | 1% | 1/6W | RN1/6FS      |
| R50                     | 40-16-1471           | FXD C FILM 470               | OHM        | 5% | 1/6W | RD1/6FS      |
| R51                     | 40-16-0471           | FXD C FILM 47                | OHM        | 5% | 1/6W | RD1/6FS      |
| R52                     | 40-16-0001           | FXD C FILM 0                 | OHM        | 5% | 1/6W | RD1/6FS      |
| R53                     | 40-16-0001           | FXD C FILM 0                 | OHM        | 5% | 1/6W | RD1/6FS      |
| R54                     | 40-16-1391           | FXD C FILM 390               | OHM        | 5% | 1/6W | RD1/6FS      |
| R55                     | 40-16-1391           | FXD C FILM 390               | OHM        | 5% | 1/6W | RD1/6FS      |
| R56                     | 40-16-0221           | FXD C FILM 22                | OHM        | 5% | 1/6W | RD1/6FS      |
| R57                     | 40-16-0221           | FXD C FILM 22                | OHM        | 5% | 1/6W | RD1/6FS      |
| R59                     | 38-00-0070           | THERMISTOR 200               | OHM        |    |      | TOSHIBA D22A |
| R60                     | 38-00-0070           | THERMISTOR 200               | OHM        |    |      | TOSHIBA D22A |
| RV1                     | 48-31-2100           | VAR M GLAZE 1K               | OHM        | B  | PH   |              |
| RV2                     | 48-31-3100           | FXD M GLAZE 10K              | OHM        | B  | PH   |              |
| RV3                     | 48-31-2100           | VAR M GLAZE 1K               | OHM        | B  | PH   |              |
| RV4                     | 48-31-3100           | FXD M GLAZE 10K              | OHM        | B  | PH   |              |
| U1A                     | 35-70-0103           | TRI 3-INPUT POSI-NAND GATES  | FAIRCHILD  |    |      | F74F10PC     |
| U1B                     | 35-76-1122           | DUAL J-K F-F WITH P/C        | FAIRCHILD  |    |      | F74F112PC    |
| U1C                     | 35-70-1126           | DUAL J-K F-F WITH P/C        | TOSHIBA    |    |      | TC74HC112P   |
| U10A                    | 35-76-5412           | OCTAL BUFFER                 | FAIRCHILD  |    |      | F74F541N     |
| U10C                    | 35-76-5412           | OCTAL BUFFER                 | FAIRCHILD  |    |      | F74F541N     |
| U11A                    | 34-21-0000           | A/D CONVERTER 8 BIT 38.5MSPS | ITT        |    |      | UVC3120      |
| U11C                    | 34-21-0000           | A/D CONVERTER 8 BIT 38.5MSPS | ITT        |    |      | UVC3120      |
| U12A                    | 36-00-1180           | HIC (H18 SAMPLE & HOLD)      | KIKUSUI    |    |      | B1509/4      |
| U12C                    | 36-00-1180           | HIC (H18 SAMPLE & HOLD)      | KIKUSUI    |    |      | B1509/4      |
| U12D                    | 34-40-0430           | ADJUSTABLE SHUNT REGULATOR   |            |    |      | NJM431L      |
| U13D                    | 34-40-0430           | ADJUSTABLE SHUNT REGULATOR   |            |    |      | NJM431L      |
| U2A                     | 35-70-0003           | QUAD 2-INPUT POSI-NAND       | FAIRCHILD  |    |      | 74F00PC      |
| U2B                     | 35-79-0020           | QUAD 2-INPUT POSI-NOR        | FAIRCHILD  |    |      | F74F3037N    |
| U4A                     | 35-71-0040           | HEX INVERTERS                | FAIRCHILD  |    |      | F74F04PC     |



| REFERENCE<br>SIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                    | 97-11-0150            |
|-----------------------|----------------------|--------------------------------|-----------------------|
| 4B                    | 35-71-0040           | HEX INVERTERS                  | FAIRCHILD F74F04PC    |
| 4C                    | 35-71-0080           | QUAD 2-INPUT POSI-AND          | FAIRCHILD F74F08PC    |
| 5A                    | 35-71-0080           | QUAD 2-INPUT POSI-AND          | FAIRCHILD F74F08PC    |
| 5B                    | 35-71-0080           | QUAD 2-INPUT POSI-AND          | FAIRCHILD F74F08PC    |
| 5C                    | 35-71-0020           | QUAD 2-INPUT POSI-NOR          | FAIRCHILD F74F02PC    |
| 6A                    | 35-71-1690           | 4-BIT UP/DOWN SYNC-BIN-COUNTER | FAIRCHILD F74F169PC   |
| 6B                    | 35-71-0320           | QUAD 2-INPUT POSI-OR           | FAIRCHILD F74F32PC    |
| 6C                    | 35-71-1690           | 4-BIT UP/DOWN SYNC-BIN-COUNTER | FAIRCHILD F74F169PC   |
| 7A                    | 35-76-2692           | 8-BIT BINARY COUNTER           | FAIRCHILD F74F269N    |
| 7C                    | 35-76-2692           | 8-BIT BINARY COUNTER           | FAIRCHILD F74F269N    |
| 8A                    | 35-07-0055           | S-RAM 2KW X 8BIT 35NS          | TMM2018D-             |
| 8C                    | 35-07-0055           | S-RAM 2KW X 8BIT 35NS          | TMM2018D-             |
| 9A                    | 35-53-5417           | OCTAL BUFFER                   | TEXAS INS. SN74HC541N |
| 9C                    | 35-53-5417           | OCTAL BUFFER                   | TEXAS INS. SN74HC541N |



|            |           |             |            |
|------------|-----------|-------------|------------|
| REFERENCE  | KIKUSUI   |             |            |
| DESIGNATOR | PARTS NO. | DESCRIPTION | 97-11-0140 |

# A17 ASSEMBLY

|     |            |                |        |             |              |
|-----|------------|----------------|--------|-------------|--------------|
| C1  | 54-40-1200 | FXD ELECT      | 10MF   | 50WV        |              |
| C2  | 52-01-2385 | FXD CER        | 2200PF | 10% 50V     | TYPE2        |
| C3  | 52-05-2468 | FXD CER        | 0.01UF | +80-20% 50V | TYPE2        |
| C4  | 55-37-2080 | FXD TANT ELECT | 4.7UF  | 35V         |              |
| C5  | 52-05-2468 | FXD CER        | 0.01UF | +80-20% 50V | TYPE2        |
| C6  | 52-06-2225 | FXD CER        | 100PF  | 10% 50V     | TYPE1        |
| C8  | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C9  | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C10 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C11 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C12 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C13 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C14 | 54-30-1960 | FXD ELECT      | 47MF   | 25WV        |              |
| C15 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C16 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C17 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C18 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C19 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C20 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C21 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C22 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C23 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C24 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C25 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C26 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C27 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C28 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C29 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C30 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C31 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C32 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C33 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C34 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C35 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C36 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C37 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C38 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C39 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C40 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C41 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C42 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C43 | 52-48-1050 | FXD CER        | 0.1UF  | 20% 25V     | D33Y5V1E     |
| C44 | 52-06-2245 | FXD CER        | 150PF  | 10% 50V     | TYPE1        |
| CR1 | 32-30-1200 | DIODE VR=60V   | IO=1A  | HITACHI     | 1SS120       |
| Q1  | 30-32-1201 | TR SI NPN      |        | TOSHIBA     | 2SC2120-Y    |
| R1  | 40-16-1391 | FXD C FILM     | 390    | OHM 5%      | 1/6W RD1/6FS |
| R2  | 42-80-2151 | FXD M FILM     | 1.5K   | OHM 1%      | 1/6W RN1/6FS |

| REFERENCE<br>SIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                    | 97-11-0140  |            |
|-----------------------|----------------------|--------------------------------|-------------|------------|
| 3                     | 42-80-2181           | FXD M FILM 1.8K                | OHM 1% 1/6W | RN1/6FS    |
| 4                     | 42-80-2561           | FXD M FILM 5.6K                | OHM 1% 1/6W | RN1/6FS    |
| 5                     | 40-16-2561           | FXD C FILM 5.6K                | OHM 5% 1/6W | RD1/6FS    |
| 6                     | 42-80-1331           | FXD M FILM 330                 | OHM 1% 1/6W | RN1/6FS    |
| 7                     | 42-80-1331           | FXD M FILM 330                 | OHM 1% 1/6W | RN1/6FS    |
| 8                     | 42-80-2181           | FXD M FILM 1.8K                | OHM 1% 1/6W | RN1/6FS    |
| 9                     | 42-80-2181           | FXD M FILM 1.8K                | OHM 1% 1/6W | RN1/6FS    |
| 10                    | 40-16-1471           | FXD C FILM 470                 | OHM 5% 1/6W | RD1/6FS    |
| 11                    | 40-16-0001           | FXD C FILM 0                   | OHM 5% 1/6W | RD1/6FS    |
| 12                    | 40-16-3101           | FXD C FILM 10K                 | OHM 5% 1/6W | RD1/6FS    |
| 1B                    | 36-00-1150           | HIC (H15 ANALOG MPX DIP)       | KIKUSUI     | B1209/9    |
| 1C                    | 34-40-0430           | ADJUSTABLE SHUNT REGULATOR     |             | NJM431L    |
| 10A                   | 35-59-0100           | PROGRAMABLE DIVIDER 5MHZ       |             | SPG8650-0  |
| 10B                   | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA     | TC74HC574P |
| 10C                   | 35-70-0326           | QUAD 2-INPUT POSI-OR           | TOSHIBA     | TC74HC32P  |
| 11A                   | 35-71-0740           | DUAL D F-F EDGE TRIGGER        | TEXAS INS.  | F74F74PC   |
| 11B                   | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA     | TC74HC574P |
| 11C                   | 35-70-0326           | QUAD 2-INPUT POSI-OR           | TOSHIBA     | TC74HC32P  |
| 12A                   | 35-71-0740           | DUAL D F-F EDGE TRIGGER        | TEXAS INS.  | F74F74PC   |
| 12B                   | 35-53-3654           | HEX BUS DRIVERS                | TOSHIBA     | TC74HC365P |
| 12C                   | 35-70-0006           | QUAD 2-INPUT POSI-NAND         | TOSHIBA     | TC74HC00P  |
| 13A                   | 35-53-3904           | DUAL DECADE COUNTERS           | TOSHIBA     | TC74HC390P |
| 13B                   | 35-73-5920           | 8-BIT REGISTERS/BIN-COUNTERS   | TEXAS INS.  | SN74LS592N |
| 13C                   | 35-71-0320           | QUAD 2-INPUT POSI-OR           | FAIRCHILD   | F74F32PC   |
| 14A                   | 35-70-0003           | QUAD 2-INPUT POSI-NAND         | FAIRCHILD   | 74F00PC    |
| 14B                   | 35-70-1613           | SYNC 4-BIT BINARY COUNTERS     | FAIRCHILD   | F74F161PC  |
| 14C                   | 36-00-1360           | HIC (H36 CLOCK GENERATOR)      | KIKUSUI     | B3209/12   |
| 2A                    | 34-00-0215           | J-FET INPUT OPE-AMP            | TEXAS INS.  | TL081CP    |
| 2B                    | 34-22-0011           | D/A CONVERTER 8BIT 70NS        | SIGNETICS   | DAC-08EN   |
| 3B                    | 36-00-1330           | HIC (H33 JITTER METER)         | KIKUSUI     | B2909/4    |
| 3C                    | 35-71-0040           | HEX INVERTERS                  | FAIRCHILD   | F74F04PC   |
| 4C                    | 35-73-5900           | 8 BIT BINARY COUNTER/RESISTERS | TEXAS INS.  | SN74LS590N |
| 5C                    | 35-73-5900           | 8 BIT BINARY COUNTER/RESISTERS | TEXAS INS.  | SN74LS590N |
| 6C                    | 35-70-0311           | DELAY ELEMENTS                 | TEXAS INS.  | SN74LS31N  |
| 7A                    | 35-76-1122           | DUAL J-K F-F WITH P/C          | FAIRCHILD   | F74F112PC  |
| 7B                    | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA     | TC74HC574P |
| 7C                    | 35-70-1386           | 3LINE TO 8LINE DECORDER        | HITACHI     | HD74HC138P |
| 8A                    | 35-71-1530           | DUAL 4-TO-1 DATA SELECTORS     | FAIRCHILD   | F74F153PC  |
| 8B                    | 35-53-5414           | OCTAL BUFFER                   | TEXAS INS.  | SN7HCS541N |
| 8C                    | 35-70-1386           | 3LINE TO 8LINE DECORDER        | HITACHI     | HD74HC138P |
| 9A                    | 35-76-1912           | 4 BIT UP/DOWN BIN. COUNTER     | FAIRCHILD   | F74F191PC  |
| 9B                    | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA     | TC74HC574P |
| 9C                    | 35-70-1386           | 3LINE TO 8LINE DECORDER        | HITACHI     | HD74HC138P |
| TL1                   | 93-00-0250           | QUARTS HC-18/U 50MHZ           | KIKUSUI     | S8506221   |
| TL2                   | 93-00-0240           | QUARTS HC-18/U 40MHZ           | KIKUSUI     | S8506211   |

REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0130

A18 ASSEMBLY

|     |            |                     |            |                   |            |
|-----|------------|---------------------|------------|-------------------|------------|
| BT1 | 94-00-0210 | BATTERY             | 3.0V 38MAH | LITHUM            | BR1225-IVD |
| C1  | 52-06-2184 | FXD CER             | 47PF       | 10% 50V TYPE1     |            |
| C3  | 52-01-2345 | FXD CER             | 1000PF     | 10% 50V TYPE2     |            |
| C5  | 52-05-2468 | FXD CER             | 0.01UF     | +80-20% 50V TYPE2 |            |
| C7  | 52-06-2225 | FXD CER             | 100PF      | 10% 50V TYPE1     |            |
| C8  | 52-05-2468 | FXD CER             | 0.01UF     | +80-20% 50V TYPE2 |            |
| C11 | 52-05-2468 | FXD CER             | 0.01UF     | +80-20% 50V TYPE2 |            |
| C13 | 52-05-2468 | FXD CER             | 0.01UF     | +80-20% 50V TYPE2 |            |
| C14 | 52-01-2385 | FXD CER             | 2200PF     | 10% 50V TYPE2     |            |
| C15 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C16 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C21 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C22 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C23 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C24 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C25 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C26 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C27 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C28 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C29 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C30 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C31 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C32 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C33 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C34 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C35 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C36 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C37 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C38 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C39 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C40 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C41 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C42 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C43 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C44 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C45 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C46 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C47 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C48 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C49 | 52-37-1000 | FXD CER             | 0.047UF    | 20% 25V TYPE1     |            |
| C50 | 54-40-1200 | FXD ELECT           | 10MF       | 50WV              |            |
| C51 | 54-40-1200 | FXD ELECT           | 10MF       | 50WV              |            |
| C52 | 54-20-1210 | FXD ELECT           | 220MF      | 16WV              | KME16VB220 |
| C54 | 52-06-2215 | FXD CER             | 82PF       | 10% 500V TYPE1    |            |
| C55 | 52-06-2194 | *****               |            |                   |            |
| CR1 | 32-92-0027 | ZENER VZ=2.5 - 2.8V |            | HITACHI           | HZS-2.7EB1 |
| CR2 | 32-30-1200 | DIODE VR=60V IO=1A  |            | HITACHI           | 1SS120     |
| CR3 | 32-30-1200 | DIODE VR=60V IO=1A  |            | HITACHI           | 1SS120     |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                  |      | 97-11-0130 |           |          |
|-------------------------|----------------------|------------------------------|------|------------|-----------|----------|
| CR4                     | 32-30-1200           | DIODE VR=60V IO=1A           |      | HITACHI    | 1SS120    |          |
| Q1                      | 30-30-9451           | TR SI NPN                    |      | NEC        | 2SC945-Q  |          |
| Q2                      | 30-30-9451           | TR SI NPN                    |      | NEC        | 2SC945-Q  |          |
| Q5                      | 30-32-1201           | TR SI NPN                    |      | TOSHIBA    | 2SC2120-Y |          |
| Q6                      | 30-32-1201           | TR SI NPN                    |      | TOSHIBA    | 2SC2120-Y |          |
| R1                      | 40-16-2101           | FXD C FILM                   | 1K   | OHM 5%     | 1/6W      | RD1/6FS  |
| R2                      | 40-16-3101           | FXD C FILM                   | 10K  | OHM 5%     | 1/6W      | RD1/6FS  |
| R4                      | 40-16-1681           | FXD C FILM                   | 680  | OHM 5%     | 1/6W      | RD1/6FS  |
| R5                      | 42-80-2101           | FXD M FILM                   | 1K   | OHM 1%     | 1/6W      | RN1/6FS  |
| R6                      | 40-16-2221           | FXD C FILM                   | 2.2K | OHM 5%     | 1/6W      | RD1/6FS  |
| R10                     | 42-80-2101           | FXD M FILM                   | 1K   | OHM 1%     | 1/6W      | RN1/6FS  |
| R11                     | 40-16-2221           | FXD C FILM                   | 2.2K | OHM 5%     | 1/6W      | RD1/6FS  |
| R13                     | 42-80-2471           | FXD M FILM                   | 4.7K | OHM 1%     | 1/6W      | RN1/6FS  |
| R14                     | 40-16-2471           | FXD C FILM                   | 4.7K | OHM 5%     | 1/6W      | RD1/6FS  |
| R24                     | 40-16-3101           | FXD C FILM                   | 10K  | OHM 5%     | 1/6W      | RD1/6FS  |
| R25                     | 42-80-3561           | FXD M FILM                   | 56K  | OHM 1%     | 1/6W      | RN1/6FS  |
| R26                     | 40-16-1821           | FXD C FILM                   | 820  | OHM 5%     | 1/6W      | RD1/6FS  |
| R27                     | 40-16-1821           | FXD C FILM                   | 820  | OHM 5%     | 1/6W      | RD1/6FS  |
| R28                     | 40-16-2391           | FXD C FILM                   | 3.9K | OHM 5%     | 1/6W      | RD1/6FS  |
| R29                     | 40-16-1271           | FXD C FILM                   | 270  | OHM 5%     | 1/6W      | RD1/6FS  |
| R30                     | 40-16-2391           | FXD C FILM                   | 3.9K | OHM 5%     | 1/6W      | RD1/6FS  |
| R31                     | 40-16-4471           | FXD C FILM                   | 470K | OHM 5%     | 1/6W      | RD1/6FS  |
| R32                     | 40-16-2821           | FXD C FILM                   | 8.2K | OHM 5%     | 1/6W      | RD1/6FS  |
| R33                     | 40-16-1821           | FXD C FILM                   | 820  | OHM 5%     | 1/6W      | RD1/6FS  |
| R34                     | 40-16-1821           | FXD C FILM                   | 820  | OHM 5%     | 1/6W      | RD1/6FS  |
| R40                     | 40-16-1681           | FXD C FILM                   | 680  | OHM 5%     | 1/6W      | RD1/6FS  |
| R41                     | 42-80-2181           | FXD M FILM                   | 1.8K | OHM 1%     | 1/6W      | RN1/6FS  |
| R42                     | 42-80-2151           | FXD M FILM                   | 1.5K | OHM 1%     | 1/6W      | RN1/6FS  |
| R43                     | 42-80-1471           | FXD M FILM                   | 470  | OHM 1%     | 1/6W      | RN1/6FS  |
| R44                     | 42-80-2151           | FXD M FILM                   | 1.5K | OHM 1%     | 1/6W      | RN1/6FS  |
| R45                     | 42-80-1471           | FXD M FILM                   | 470  | OHM 1%     | 1/6W      | RN1/6FS  |
| R46                     | 42-80-1821           | FXD M FILM                   | 820  | OHM 1%     | 1/6W      | RN1/6FS  |
| R47                     | 42-80-2121           | FXD M FILM                   | 1.2K | OHM 1%     | 1/6W      | RN1/6FS  |
| R48                     | 42-80-1331           | FXD M FILM                   | 330  | OHM 1%     | 1/6W      | RN1/6FS  |
| R49                     | 42-80-2391           | FXD M FILM                   | 3.9K | OHM 1%     | 1/6W      | RN1/6FS  |
| R50                     | 42-80-1471           | FXD M FILM                   | 470  | OHM 1%     | 1/6W      | RN1/6FS  |
| R51                     | 40-16-1471           | FXD C FILM                   | 470  | OHM 5%     | 1/6W      | RD1/6FS  |
| R52                     | 40-16-1471           | FXD C FILM                   | 470  | OHM 5%     | 1/6W      | RD1/6FS  |
| R53                     | 40-16-1471           | FXD C FILM                   | 470  | OHM 5%     | 1/6W      | RD1/6FS  |
| R55                     | 40-16-2101           | FXD C FILM                   | 1K   | OHM 5%     | 1/6W      | RD1/6FS  |
| R56                     | 42-80-2101           | FXD M FILM                   | 1K   | OHM 1%     | 1/6W      | RN1/6FS  |
| R57                     | 42-80-1121           | FXD M FILM                   | 120  | OHM 1%     | 1/6W      | RN1/6FS  |
| R58                     | 42-80-0561           | FXD M FILM                   | 56   | OHM 1%     | 1/6W      | RN1/6FS  |
| R59                     | 40-16-1331           | FXD C FILM                   | 330  | OHM 5%     | 1/6W      | RD1/6FS  |
| RV1                     | 48-31-1500           | VAR M GLAZE                  | 500  | OHM B      | PH        |          |
| RV2                     | 48-31-3200           | FXD M GLAZE                  | 20K  | OHM B      | PH        |          |
| RV3                     | 48-31-2500           | VAR M GLAZE                  | 5K   | OHM B      | PH        |          |
| RV4                     | 48-31-2500           | VAR M GLAZE                  | 5K   | OHM B      | PH        |          |
| RV5                     | 48-31-2100           | VAR M GLAZE                  | 1K   | OHM B      | PH        |          |
| U1A                     | 34-69-0030           | TRIPLE 2-CHANNEL MULTIPLEXER |      |            | TOSHIBA   | TC4053BP |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                    | 97-11-0130 |            |
|-------------------------|----------------------|--------------------------------|------------|------------|
| U1B                     | 36-00-1200           | HIC (H20 INTERPOLATOR)         | KIKUSUI    | B4009/9    |
| U1C                     | 36-00-1320           | HIC (H32 ST.SWEEP DEGLITCHER)  | KIKUSUI    | B2809/12   |
| U1D                     | 34-40-0430           | ADJUSTABLE SHUNT REGULATOR     |            | NJM431L    |
| U2A                     | 34-22-0011           | D/A CONVERTER 8BIT 70NS        | SIGNETICS  | DAC-08EN   |
| U2B                     | 34-22-0011           | D/A CONVERTER 8BIT 70NS        | SIGNETICS  | DAC-08EN   |
| U2C                     | 36-20-0100           | D/A CONVERTER 12BIT            | HITACHI    | HA17012PB  |
| U3A                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U3B                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U3C                     | 35-53-1744           | HEX D-TYPE FLIP FLOP           | TOSHIBA    | TC74HC174P |
| U3D                     | 35-70-0541           | 4-WIDE 2-INPUT AND-OR-INV GATE | TEXAS INS. | SN74LS54N  |
| U3F                     | 35-53-0304           | 8-INPUT POSI-NAND GATE         | TOSHIBA    | TC74HC30P  |
| U4A                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U4B                     | 35-53-0214           | DUAL 4-INPUT POSI-AND          | TOSHIBA    | TC74HC21P  |
| U4C                     | 35-53-2834           | 4 BIT BINARY FULL ADDER        | TOSHIBA    | TC74HC283P |
| U4D                     | 35-53-2454           | OCTAL BUS TRANSCEIVER          | TOSHIBA    | TC74HC245P |
| U4F                     | 35-70-0326           | QUAD 2-INPUT POSI-OR           | TOSHIBA    | TC74HC32P  |
| U5A                     | 35-53-2834           | 4 BIT BINARY FULL ADDER        | TOSHIBA    | TC74HC283P |
| U5B                     | 35-56-0025           | DUAL 4-INPUT NOR GATES         | TOSHIBA    | TC74HC4002 |
| U5C                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U5F                     | 35-70-1386           | 3LINE TO 8LINE DECODER         | HITACHI    | HD74HC138P |
| U6A                     | 35-56-0111           | S-RAM 2KX8BIT CMOS             | HITACHI    | HM6116P-3  |
| U6C                     | 35-07-0060           | S-RAM 8K X 8BIT 150NS          | TOSHIBA    | TC5564LP-  |
| U6D                     | 35-02-0010           | PIO                            |            | TMP82C55AP |
| U6F                     | 35-70-0326           | QUAD 2-INPUT POSI-OR           | TOSHIBA    | TC74HC32P  |
| U7A                     | 35-53-2834           | 4 BIT BINARY FULL ADDER        | TOSHIBA    | TC74HC283P |
| U7B                     | 35-53-2834           | 4 BIT BINARY FULL ADDER        | TOSHIBA    | TC74HC283P |
| U7C                     | 35-53-2834           | 4 BIT BINARY FULL ADDER        | TOSHIBA    | TC74HC283P |
| U7D                     | 35-53-0104           | TRIPLE 3-INPUT POSI-NAND GATES | TOSHIBA    | TC74HC10P  |
| U7E                     | 35-70-0046           | HEX INVERTERS                  | TOSHIBA    | TC74HC04P  |
| U7F                     | 35-70-0086           | QUAD 2-INPUT POSI-AND          | TOSHIBA    | TC74HC08P  |
| U8A                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U8B                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U8C                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA    | TC74HC157P |
| U8D                     | 35-56-0405           | 12 STAGE BINARY COUNTER        | TOSHIBA    | TC74HC4040 |
| U8E                     | 35-70-1126           | DUAL J-K F-F WITH P/C          | TOSHIBA    | TC74HC112P |
| U8F                     | 35-70-1126           | DUAL J-K F-F WITH P/C          | TOSHIBA    | TC74HC112P |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION   |               |             |              | 97-11-0110 |
|-------------------------|----------------------|---------------|---------------|-------------|--------------|------------|
| A20 ASSEMBLY            |                      |               |               |             |              |            |
| C1                      | 52-77-1010           | FXD CER       | 1000PF        | 250VAC      | FOR UL & CSA |            |
| C2                      | 52-77-1010           | FXD CER       | 1000PF        | 250VAC      | FOR UL & CSA |            |
| T1                      | 67-10-1760           | INDUCTOR      | 1MH           | 2.5A        |              | SC-02-10A2 |
| A21 ASSEMBLY            |                      |               |               |             |              |            |
| 97-11-0180              |                      |               |               |             |              |            |
| L1                      | 67-95-0010           | INDUCTOR      | L-2874        |             |              |            |
| L2                      | 67-95-0010           | INDUCTOR      | L-2874        |             |              |            |
| L3                      | 67-10-0870           | INDUCTOR      | 1UH           |             |              |            |
| L4                      | 67-10-0870           | INDUCTOR      | 1UH           |             |              |            |
| R1                      | 40-27-1332           | FXD C FILM    | 330           | OHM 5% 1/4W |              |            |
| R2                      | 40-27-1332           | FXD C FILM    | 330           | OHM 5% 1/4W |              |            |
| R3                      | 40-16-1561           | FXD C FILM    | 560           | OHM 5% 1/6W |              | RD1/6FS    |
| R4                      | 40-16-1561           | FXD C FILM    | 560           | OHM 5% 1/6W |              | RD1/6FS    |
| A22 ASSEMBLY            |                      |               |               |             |              |            |
| C1                      | 52-98-1010           | FXD CER       | 1000PF        | +80-20%     | 6.3KV TYPE1  |            |
| C2                      | 52-98-1000           | FXD CER       | 4700PF        | +80-20%     | 3.15KV TYPE1 |            |
| C3                      | 52-98-1000           | FXD CER       | 4700PF        | +80-20%     | 3.15KV TYPE1 |            |
| C4                      | 52-98-1000           | FXD CER       | 4700PF        | +80-20%     | 3.15KV TYPE1 |            |
| C5                      | 52-98-1010           | FXD CER       | 1000PF        | +80-20%     | 6.3KV TYPE1  |            |
| C6                      | 52-98-1010           | FXD CER       | 1000PF        | +80-20%     | 6.3KV TYPE1  |            |
| C7                      | 52-98-1010           | FXD CER       | 1000PF        | +80-20%     | 6.3KV TYPE1  |            |
| C8                      | 52-98-1010           | FXD CER       | 1000PF        | +80-20%     | 6.3KV TYPE1  |            |
| C9                      | 52-98-1010           | FXD CER       | 1000PF        | +80-20%     | 6.3KV TYPE1  |            |
| C10                     | 52-98-1010           | FXD CER       | 1000PF        | +80-20%     | 6.3KV TYPE1  |            |
| C11                     | 52-98-1010           | FXD CER       | 1000PF        | +80-20%     | 6.3KV TYPE1  |            |
| C12                     | 52-03-3469           | FXD CER       | 0.01UF        | +100-0%     | 500V TYPE2   |            |
| CR1                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| CR2                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| CR3                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| CR4                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| CR5                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| CR6                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| CR7                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| CR8                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| CR9                     | 32-90-1951           | DIODE VR=6KV  | FAST RECOVERY | SANKEN      |              | GHV-06SSN  |
| R1                      | 40-16-2101           | FXD C FILM    | 1K            | OHM 5% 1/6W |              | RD1/6FS    |
| R2                      | 40-37-8101           | FXD C FILM    | 10M           | OHM 5% 1/2W |              |            |
| T1                      | 63-92-0190           | SWITING TRANS | HV-6          | KIKUSUI     |              | S8513932   |



### 7.1.3 COM 7100A Parts List

Table 7-5 shows each parts used for COM 7100A by assembly.

| Assembly     | CODE NO.   | Description                                                                                                                  |
|--------------|------------|------------------------------------------------------------------------------------------------------------------------------|
| B ASSEMBLY   |            | Parts used for Chassis.                                                                                                      |
| A1 ASSEMBLY  | 36-00-1030 | Parts used for CH1 and CH2 ATTENUATOR boards. Note that the chip parts are not included.                                     |
| A3 ASSEMBLY  | 36-00-1040 | Parts used for CH3 and CH4 ATTENUATOR boards. Note that the chip parts are not included.                                     |
| A4 ASSEMBLY  | 97-11-0021 | Parts used for MAIN board. (VERTICAL PREAMPLIFIER, TRIG & A/B SWEEP GENERATOR and HORIZONTAL SWITCH & Z AXIS CONTROL board.) |
| A5 ASSEMBLY  | 97-11-0030 | Parts used for VERTICAL & HORIZONTAL OUTPUT AMPLIFIER board.                                                                 |
| A6 ASSEMBLY  | 97-11-0040 | Parts used for Z AXIS AMPLIFIER board.                                                                                       |
| A7 ASSEMBLY  | 97-11-0050 | Parts used for CRT CONTROL board.                                                                                            |
| A8 ASSEMBLY  | 97-11-0060 | Parts used for MAIN CPU board.                                                                                               |
| A10 ASSEMBLY | 97-11-0070 | Parts used for PANEL CONTROLS (1/2) board.                                                                                   |
| A11 ASSEMBLY | 97-11-0081 | Parts used for PANEL CONTROLS (2/2) board.                                                                                   |
| A12 ASSEMBLY | 97-11-0090 | Parts used for POWER SUPPLY UNIT board.                                                                                      |
| A13 ASSEMBLY | 97-11-0100 | Parts used for BUS INTERCONNECTIONS board.                                                                                   |
| A20 ASSEMBLY | 97-11-0110 | Parts used for LINE FILTER board.                                                                                            |
| A22 ASSEMBLY | 97-11-0200 | Parts used for HIGH VOLTAGE UNIT board.                                                                                      |

Table 7-5 List of ASSEMBLIES for COM 7100A



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION              |         |          |
|-------------------------|----------------------|--------------------------|---------|----------|
| B ASSEMBLY              |                      |                          |         |          |
| V1                      | 21-46-0614           | CATHODE RAY TUBE         | TOSHIBA | 150CW31  |
| **                      | 66-21-0082           | ROTATION COIL            | KIKUSUI | S8607331 |
| **                      | 76-52-0051           | FAN (DC 12V)             |         |          |
| A1 ASSEMBLY (CH1)       |                      |                          |         |          |
| H3                      | 36-00-1030           | HIC (H3 CH1,CH2 1ST ATT) | KIKUSUI | B0009/03 |
| J1                      | 83-30-1190           | BNC CONNECTOR            |         | *1       |
| K1                      | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *1       |
| K2                      | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *1       |
| K3                      | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *1       |
| A1 ASSEMBLY (CH2)       |                      |                          |         |          |
| H3                      | 36-00-1030           | HIC (H3 CH1,CH2 1ST ATT) | KIKUSUI | B0009/03 |
| J1                      | 83-30-1190           | BNC CONNECTOR            |         | *1       |
| K1                      | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *1       |
| K2                      | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *1       |
| K3                      | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *1       |
| A3 ASSEMBLY             |                      |                          |         |          |
| H4                      | 36-00-1040           | HIC (H4 CH3/CH4 1ST ATT) | KIKUSUI | B0109/02 |
| J1                      | 83-30-1190           | BNC CONNECTOR            |         | *2       |
| J2                      | 83-30-1190           | BNC CONNECTOR            |         | *2       |
| K1                      | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *2       |
| K2                      | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *2       |
| K11                     | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *2       |
| K12                     | 71-07-0370           | RELAY (DC 5V)            | DS1-S   | *2       |

NOTE : \*1. The H3 is a Attenuator unit consisted of case,shield plate,bracket,PC Board,  
J1,K1,K2,K3 and other component.

\*2. The H4 is a Attenuator unit consisted of case,shield plate,bracket,PC Board,  
J1,J2,K1,K2,K11,K12 and other component.

REFERENCE KIKUSUI  
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#### A4 ASSEMBLY

|     |            |                |                |           |     |
|-----|------------|----------------|----------------|-----------|-----|
| C1  | 54-40-1210 | FXD ELECT      | 22MF           | 50VV      |     |
| C2  | 54-40-1210 | FXD ELECT      | 22MF           | 50VV      |     |
| C3  | 54-40-1210 | FXD ELECT      | 22MF           | 50VV      |     |
| C4  | 54-40-1210 | FXD ELECT      | 22MF           | 50VV      |     |
| C5  | 54-40-1210 | FXD ELECT      | 22MF           | 50VV      |     |
| C6  | 54-40-1210 | FXD ELECT      | 22MF           | 50VV      |     |
| C7  | 56-48-1000 | FXD CER        | EMI FILTER     |           |     |
| C8  | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C9  | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C10 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |     |
| C11 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |     |
| C12 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C13 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |     |
| C14 | 52-01-2305 | FXD CER        | 470PF 10%      | 50V TYPE2 |     |
| C15 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C16 | 52-06-2184 | FXD CER        | 47PF 10%       | 50V TYPE1 |     |
| C17 | 52-06-2184 | FXD CER        | 47PF 10%       | 50V TYPE1 |     |
| C18 | 52-06-2184 | FXD CER        | 47PF 10%       | 50V TYPE1 |     |
| C19 | 52-06-2184 | FXD CER        | 47PF 10%       | 50V TYPE1 |     |
| C20 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C21 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C22 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C23 | 52-06-2245 | FXD CER        | 150PF 10%      | 50V TYPE1 |     |
| C24 | 55-37-2050 | FXD TANT ELECT | 1UF            | 35V       |     |
| C25 | 55-37-2050 | FXD TANT ELECT | 1UF            | 35V       |     |
| C26 | 55-37-2050 | FXD TANT ELECT | 1UF            | 35V       |     |
| C27 | 54-40-1200 | FXD ELECT      | 10MF           | 50VV      |     |
| C28 | 54-40-1200 | FXD ELECT      | 10MF           | 50VV      |     |
| C31 | 52-06-2225 | FXD CER        | 100PF 10%      | 50V TYPE1 |     |
| C32 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C33 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C34 | 52-05-2468 | FXD CER        | 0.01UF +80-20% | 50V TYPE2 |     |
| C35 | 50-45-3530 | FXD PLSTC FILM | 0.1MF          | 5% 63VV   | MMH |
| C36 | 52-06-2245 | FXD CER        | 150PF 10%      | 50V TYPE1 |     |
| C38 | 52-06-2245 | FXD CER        | 150PF 10%      | 50V TYPE1 |     |
| C40 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C41 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C42 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C43 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C44 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C45 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C46 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C47 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C48 | 52-01-2265 | FXD CER        | 220PF 10%      | 50V TYPE2 |     |
| C49 | 52-01-2345 | FXD CER        | 1000PF 10%     | 50V TYPE2 |     |
| C50 | 52-01-2345 | FXD CER        | 1000PF 10%     | 50V TYPE2 |     |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION      | 97-11-0021        |     |
|-------------------------|----------------------|------------------|-------------------|-----|
| C51                     | 52-01-2345           | FXD CER 1000PF   | 10% 50V TYPE2     |     |
| C52                     | 52-01-2345           | FXD CER 1000PF   | 10% 50V TYPE2     |     |
| C53                     | 52-01-2345           | FXD CER 1000PF   | 10% 50V TYPE2     |     |
| C54                     | 52-01-2345           | FXD CER 1000PF   | 10% 50V TYPE2     |     |
| C55                     | 50-65-3570           | FXD PLSTC FILM   | 0.01MF 5% 100WV   | AWS |
| C56                     | 50-65-0540           | FXD M PLSTC FILM | 1UF 5% 100WV      |     |
| C57                     | 50-65-3570           | FXD PLSTC FILM   | 0.01MF 5% 100WV   | AWS |
| C58                     | 50-65-0540           | FXD M PLSTC FILM | 1UF 5% 100WV      |     |
| C59                     | 52-06-2184           | FXD CER 47PF     | 10% 50V TYPE1     |     |
| C60                     | 52-06-2184           | FXD CER 47PF     | 10% 50V TYPE1     |     |
| C61                     | 52-06-2184           | FXD CER 47PF     | 10% 50V TYPE1     |     |
| C62                     | 52-06-2184           | FXD CER 47PF     | 10% 50V TYPE1     |     |
| C65                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C67                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C68                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C69                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C70                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C71                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C72                     | 55-37-2050           | FXD TANT ELECT   | 1UF 35V           |     |
| C73                     | 55-37-2050           | FXD TANT ELECT   | 1UF 35V           |     |
| C74                     | 55-37-2050           | FXD TANT ELECT   | 1UF 35V           |     |
| C75                     | 55-37-2050           | FXD TANT ELECT   | 1UF 35V           |     |
| C76                     | 50-67-0030           | FXD PLSTC FILM   | 0.01MF 10% 100WV  |     |
| C77                     | 54-30-1970           | FXD ELECT        | 100MF 25V         |     |
| C78                     | 50-67-0050           | FXD PLSTC FILM   | 0.047MF 10% 100WV |     |
| C79                     | 52-06-2204           | FXD CER 68P      | 10% 50V TYPE1     |     |
| C80                     | 54-40-1200           | FXD ELECT        | 10MF 50V          |     |
| C81                     | 55-37-2100           | FXD TANT ELECT   | 10UF 35V          |     |
| C83                     | 54-40-1210           | FXD ELECT        | 22MF 50V          |     |
| C84                     | 54-30-1970           | FXD ELECT        | 100MF 25V         |     |
| C85                     | 54-30-1970           | FXD ELECT        | 100MF 25V         |     |
| C86                     | 52-01-2385           | FXD CER 2200PF   | 10% 50V TYPE2     |     |
| C88                     | 52-01-2265           | FXD CER 220PF    | 10% 50V TYPE2     |     |
| C89                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C90                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C91                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C92                     | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C93                     | 54-40-1210           | FXD ELECT        | 22MF 50V          |     |
| C94                     | 54-30-1970           | FXD ELECT        | 100MF 25V         |     |
| C95                     | 54-30-1970           | FXD ELECT        | 100MF 25V         |     |
| C96                     | 54-30-1970           | FXD ELECT        | 100MF 25V         |     |
| C97                     | 54-30-1970           | FXD ELECT        | 100MF 25V         |     |
| C98                     | 56-48-1000           | FXD CER          | EMI FILTER        |     |
| C99                     | 56-48-1000           | FXD CER          | EMI FILTER        |     |
| C100                    | 56-48-1000           | FXD CER          | EMI FILTER        |     |
| C101                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C102                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C103                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C104                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C105                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C106                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C107                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C108                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |
| C109                    | 52-05-2468           | FXD CER 0.01UF   | +80-20% 50V TYPE2 |     |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                      | 97-11-0021 |           |
|-------------------------|----------------------|----------------------------------|------------|-----------|
| C110                    | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |           |
| C111                    | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |           |
| C112                    | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |           |
| C113                    | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |           |
| C114                    | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |           |
| C115                    | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |           |
| C116                    | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |            |           |
| C117                    | 52-06-2225           | FXD CER 100PF 10% 50V TYPE1      |            |           |
| C118                    | 55-37-2050           | FXD TANT ELECT 1UF 35V           |            |           |
| C119                    | 52-06-2102           | FXD CER 10P 10% 50V TYPE1        |            |           |
| C120                    | 52-06-2165           | FXD CER 33PF 10% 500V TYPE1      |            |           |
| C121                    | 55-37-2100           | FXD TANT ELECT 10UF 35V          |            |           |
| C122                    | 52-01-2305           | FXD CER 470PF 10% 50V TYPE2      |            |           |
| C124                    | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |           |
| C125                    | 52-06-3125           | FXD CER 15PF 10% 500V TYPE1      |            |           |
| C126                    | 52-06-3125           | FXD CER 15PF 10% 500V TYPE1      |            |           |
| C132                    | 52-06-2102           | FXD CER 10P 10% 50V TYPE1        |            |           |
| C134                    | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |            |           |
| C135                    | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |            |           |
| CR1                     | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR2                     | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR3                     | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR4                     | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR5                     | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR6                     | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR7                     | 32-30-0860           | DIODE VR=30V IO=30MA             | HITACHI    | 1SS86     |
| CR8                     | 32-30-0860           | DIODE VR=30V IO=30MA             | HITACHI    | 1SS86     |
| CR9                     | 32-92-0100           | ZENER VZ=10.1-10.6V P=0.4W       | NEC        | RD10JB3   |
| CR10                    | 32-92-0056           | ZENER VZ=5.5 - 5.8V P=0.4W       | NEC        | RD5.6JB2  |
| CR11                    | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR12                    | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR13                    | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR14                    | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CR15                    | 32-30-1200           | DIODE VR=60V IO=1A               | HITACHI    | 1SS120    |
| CV1                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| CV2                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| CV3                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| CV4                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| CV5                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| CV6                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| CV7                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| CV8                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| CV9                     | 57-10-1242           | VAR CER 5.6-20PF                 | ALPS       | CTZ31E    |
| Q1                      | 30-31-9071           | TR SI NPN                        | HITACHI    | 2SC1907   |
| Q2                      | 30-31-9071           | TR SI NPN                        | HITACHI    | 2SC1907   |
| Q3                      | 30-31-9071           | TR SI NPN                        | HITACHI    | 2SC1907   |
| Q4                      | 30-31-9071           | TR SI NPN                        | HITACHI    | 2SC1907   |
| Q5                      | 30-11-0051           | TR SI PNP                        | NEC        | 2SA1005-L |
| Q6                      | 30-31-9071           | TR SI NPN                        | HITACHI    | 2SC1907   |
| Q7                      | 30-32-1201           | TR SI NPN                        | TOSHIBA    | 2SC2120-Y |
| Q8                      | 30-32-1201           | TR SI NPN                        | TOSHIBA    | 2SC2120-Y |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION |    | 97-11-0021 |      |             |           |
|-------------------------|----------------------|-------------|----|------------|------|-------------|-----------|
| Q9                      | 30-30-9451           | TR          | SI | NPN        |      | NEC         | 2SC945-Q  |
| Q10                     | 30-30-9451           | TR          | SI | NPN        |      | NEC         | 2SC945-Q  |
| Q11                     | 30-10-8441           | TR          | SI | PNP        |      | HITACHI     | 2SA844-D  |
| Q12                     | 30-30-9451           | TR          | SI | NPN        |      | NEC         | 2SC945-Q  |
| Q13                     | 30-31-9071           | TR          | SI | NPN        |      | HITACHI     | 2SC1907   |
| Q14                     | 30-31-9071           | TR          | SI | NPN        |      | HITACHI     | 2SC1907   |
| Q15                     | 30-32-1201           | TR          | SI | NPN        |      | TOSHIBA     | 2SC2120-Y |
| Q16                     | 30-32-1201           | TR          | SI | NPN        |      | TOSHIBA     | 2SC2120-Y |
| Q17                     | 30-30-9451           | TR          | SI | NPN        |      | NEC         | 2SC945-Q  |
| Q18                     | 30-30-9451           | TR          | SI | NPN        |      | NEC         | 2SC945-Q  |
| Q19                     | 30-11-0051           | TR          | SI | PNP        |      | NEC         | 2SA1005-L |
| R1                      | 40-16-2101           | FXD         | C  | FILM       | 1K   | OHM 5% 1/6W | RD1/6FS   |
| R2                      | 40-16-2101           | FXD         | C  | FILM       | 1K   | OHM 5% 1/6W | RD1/6FS   |
| R3                      | 42-80-0101           | FXD         | M  | FILM       | 10   | OHM 1% 1/6W | RN1/6FS   |
| R4                      | 42-80-1391           | FXD         | M  | FILM       | 390  | OHM 1% 1/6W | RN1/6FS   |
| R5                      | 42-80-3181           | FXD         | M  | FILM       | 18K  | OHM 1% 1/6W | RN1/6FS   |
| R6                      | 42-80-2181           | FXD         | M  | FILM       | 1.8K | OHM 1% 1/6W | RN1/6FS   |
| R7                      | 40-16-3221           | FXD         | C  | FILM       | 22K  | OHM 5% 1/6W | RD1/6FS   |
| R8                      | 40-16-3221           | FXD         | C  | FILM       | 22K  | OHM 5% 1/6W | RD1/6FS   |
| R9                      | 40-16-1561           | FXD         | C  | FILM       | 560  | OHM 5% 1/6W | RD1/6FS   |
| R10                     | 40-16-3101           | FXD         | C  | FILM       | 10K  | OHM 5% 1/6W | RD1/6FS   |
| R11                     | 40-16-1101           | FXD         | C  | FILM       | 100  | OHM 5% 1/6W | RD1/6FS   |
| R12                     | 40-16-3101           | FXD         | C  | FILM       | 10K  | OHM 5% 1/6W | RD1/6FS   |
| R13                     | 40-16-1101           | FXD         | C  | FILM       | 100  | OHM 5% 1/6W | RD1/6FS   |
| R14                     | 42-80-1181           | FXD         | M  | FILM       | 180  | OHM 1% 1/6W | RN1/6FS   |
| R15                     | 42-80-1181           | FXD         | M  | FILM       | 180  | OHM 1% 1/6W | RN1/6FS   |
| R16                     | 40-16-1561           | FXD         | C  | FILM       | 560  | OHM 5% 1/6W | RD1/6FS   |
| R17                     | 40-16-1221           | FXD         | C  | FILM       | 220  | OHM 5% 1/6W | RD1/6FS   |
| R18                     | 42-80-1181           | FXD         | M  | FILM       | 180  | OHM 1% 1/6W | RN1/6FS   |
| R19                     | 42-80-1181           | FXD         | M  | FILM       | 180  | OHM 1% 1/6W | RN1/6FS   |
| R20                     | 40-16-1561           | FXD         | C  | FILM       | 560  | OHM 5% 1/6W | RD1/6FS   |
| R21                     | 40-16-1221           | FXD         | C  | FILM       | 220  | OHM 5% 1/6W | RD1/6FS   |
| R22                     | 40-16-0391           | FXD         | C  | FILM       | 39   | OHM 5% 1/6W | RD1/6FS   |
| R23                     | 42-80-0821           | FXD         | M  | FILM       | 82   | OHM 1% 1/6W | RN1/6FS   |
| R24                     | 40-16-0391           | FXD         | C  | FILM       | 39   | OHM 5% 1/6W | RD1/6FS   |
| R25                     | 42-80-0821           | FXD         | M  | FILM       | 82   | OHM 1% 1/6W | RN1/6FS   |
| R26                     | 40-16-3101           | FXD         | C  | FILM       | 10K  | OHM 5% 1/6W | RD1/6FS   |
| R27                     | 40-16-2471           | FXD         | C  | FILM       | 4.7K | OHM 5% 1/6W | RD1/6FS   |
| R28                     | 40-16-3101           | FXD         | C  | FILM       | 10K  | OHM 5% 1/6W | RD1/6FS   |
| R30                     | 40-16-2561           | FXD         | C  | FILM       | 5.6K | OHM 5% 1/6W | RD1/6FS   |
| R31                     | 40-16-2561           | FXD         | C  | FILM       | 5.6K | OHM 5% 1/6W | RD1/6FS   |
| R32                     | 40-16-2471           | FXD         | C  | FILM       | 4.7K | OHM 5% 1/6W | RD1/6FS   |
| R33                     | 40-16-2471           | FXD         | C  | FILM       | 4.7K | OHM 5% 1/6W | RD1/6FS   |
| R34                     | 40-16-2821           | FXD         | C  | FILM       | 8.2K | OHM 5% 1/6W | RD1/6FS   |
| R35                     | 40-16-2821           | FXD         | C  | FILM       | 8.2K | OHM 5% 1/6W | RD1/6FS   |
| R36                     | 40-16-2271           | FXD         | C  | FILM       | 2.7K | OHM 5% 1/6W | RD1/6FS   |
| R37                     | 40-16-2561           | FXD         | C  | FILM       | 5.6K | OHM 5% 1/6W | RD1/6FS   |
| R38                     | 40-16-1821           | FXD         | C  | FILM       | 820  | OHM 5% 1/6W | RD1/6FS   |
| R39                     | 40-16-3101           | FXD         | C  | FILM       | 10K  | OHM 5% 1/6W | RD1/6FS   |
| R40                     | 40-16-2331           | FXD         | C  | FILM       | 3.3K | OHM 5% 1/6W | RD1/6FS   |
| R41                     | 40-16-1221           | FXD         | C  | FILM       | 220  | OHM 5% 1/6W | RD1/6FS   |
| R42                     | 40-16-1221           | FXD         | C  | FILM       | 220  | OHM 5% 1/6W | RD1/6FS   |
| R43                     | 40-16-1101           | FXD         | C  | FILM       | 100  | OHM 5% 1/6W | RD1/6FS   |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION     | 97-11-0021  |              |
|-------------------------|----------------------|-----------------|-------------|--------------|
| R44                     | 40-16-3331           | FXD C FILM 33K  | OHM 5% 1/6W | RD1/6FS      |
| R45                     | 42-80-2221           | FXD M FILM 2.2K | OHM 1% 1/6W | RN1/6FS      |
| R46                     | 42-80-2391           | FXD M FILM 3.9K | OHM 1% 1/6W | RN1/6FS      |
| R47                     | 40-16-0001           | FXD C FILM 0    | OHM 5% 1/6W | RD1/6FS      |
| R48                     | 38-00-0080           | THERMISTOR 2500 | OHM         | TOSHIBA D33A |
| R49                     | 40-16-3221           | FXD C FILM 22K  | OHM 5% 1/6W | RD1/6FS      |
| R50                     | 40-16-3101           | FXD C FILM 10K  | OHM 5% 1/6W | RD1/6FS      |
| R51                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R53                     | 42-80-0911           | FXD M FILM 91   | OHM 1% 1/6W | RN1/6FS      |
| R54                     | 42-80-0911           | FXD M FILM 91   | OHM 1% 1/6W | RN1/6FS      |
| R55                     | 40-16-3221           | FXD C FILM 22K  | OHM 5% 1/6W | RD1/6FS      |
| R56                     | 40-16-3221           | FXD C FILM 22K  | OHM 5% 1/6W | RD1/6FS      |
| R57                     | 40-16-5101           | FXD C FILM 1M   | OHM 5% 1/6W | RD1/6FS      |
| R58                     | 40-16-5101           | FXD C FILM 1M   | OHM 5% 1/6W | RD1/6FS      |
| R59                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R60                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R61                     | 40-16-2331           | FXD C FILM 3.3K | OHM 5% 1/6W | RD1/6FS      |
| R62                     | 40-16-2681           | FXD C FILM 6.8K | OHM 5% 1/6W | RD1/6FS      |
| R63                     | 40-16-2681           | FXD C FILM 6.8K | OHM 5% 1/6W | RD1/6FS      |
| R64                     | 40-16-2331           | FXD C FILM 3.3K | OHM 5% 1/6W | RD1/6FS      |
| R65                     | 40-16-3101           | FXD C FILM 10K  | OHM 5% 1/6W | RD1/6FS      |
| R66                     | 40-16-2821           | FXD C FILM 8.2K | OHM 5% 1/6W | RD1/6FS      |
| R68                     | 40-16-2271           | FXD C FILM 2.7K | OHM 5% 1/6W | RD1/6FS      |
| R70                     | 40-16-2331           | FXD C FILM 3.3K | OHM 5% 1/6W | RD1/6FS      |
| R71                     | 40-16-1471           | FXD C FILM 470  | OHM 5% 1/6W | RD1/6FS      |
| R72                     | 40-16-1681           | FXD C FILM 680  | OHM 5% 1/6W | RD1/6FS      |
| R73                     | 42-80-2391           | FXD M FILM 3.9K | OHM 1% 1/6W | RN1/6FS      |
| R74                     | 42-80-2331           | FXD M FILM 3.3K | OHM 1% 1/6W | RN1/6FS      |
| R75                     | 40-16-3271           | FXD C FILM 27K  | OHM 5% 1/6W | RD1/6FS      |
| R76                     | 40-16-3101           | FXD C FILM 10K  | OHM 5% 1/6W | RD1/6FS      |
| R77                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R78                     | 40-16-1151           | FXD C FILM 150  | OHM 5% 1/6W | RD1/6FS      |
| R79                     | 40-16-2151           | FXD C FILM 1.5K | OHM 5% 1/6W | RD1/6FS      |
| R80                     | 40-16-1561           | FXD C FILM 560  | OHM 5% 1/6W | RD1/6FS      |
| R81                     | 40-16-2271           | FXD C FILM 2.7K | OHM 5% 1/6W | RD1/6FS      |
| R82                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R83                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R84                     | 40-16-2121           | FXD C FILM 1.2K | OHM 5% 1/6W | RD1/6FS      |
| R85                     | 40-16-1471           | FXD C FILM 470  | OHM 5% 1/6W | RD1/6FS      |
| R86                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R87                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R88                     | 40-16-2101           | FXD C FILM 1K   | OHM 5% 1/6W | RD1/6FS      |
| R89                     | 40-16-1271           | FXD C FILM 270  | OHM 5% 1/6W | RD1/6FS      |
| R90                     | 40-16-1221           | FXD C FILM 220  | OHM 5% 1/6W | RD1/6FS      |
| R91                     | 42-80-2221           | FXD M FILM 2.2K | OHM 1% 1/6W | RN1/6FS      |
| R92                     | 42-80-2681           | FXD M FILM 6.8K | OHM 1% 1/6W | RN1/6FS      |
| R93                     | 40-16-1101           | FXD C FILM 100  | OHM 5% 1/6W | RD1/6FS      |
| R94                     | 40-16-0101           | FXD C FILM 10   | OHM 5% 1/6W | RD1/6FS      |
| R95                     | 42-80-3101           | FXD M FILM 10K  | OHM 1% 1/6W | RN1/6FS      |
| R96                     | 42-80-3101           | FXD M FILM 10K  | OHM 1% 1/6W | RN1/6FS      |
| R97                     | 42-80-2131           | FXD M FILM 1.3K | OHM 1% 1/6W | RN1/6FS      |
| R98                     | 42-80-2101           | FXD M FILM 1K   | OHM 1% 1/6W | RN1/6FS      |
| R99                     | 40-16-3101           | FXD C FILM 10K  | OHM 5% 1/6W | RD1/6FS      |
| R100                    | 42-80-2131           | FXD M FILM 1.3K | OHM 1% 1/6W | RN1/6FS      |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION |         | 97-11-0021 |     |         |                |
|-------------------------|----------------------|-------------|---------|------------|-----|---------|----------------|
| R101                    | 42-80-2101           | FXD         | M FILM  | 1K         | OHM | 1% 1/6W | RN1/6FS        |
| R102                    | 40-16-3101           | FXD         | C FILM  | 10K        | OHM | 5% 1/6W | RD1/6FS        |
| R103                    | 42-80-2121           | FXD         | M FILM  | 1.2K       | OHM | 1% 1/6W | RN1/6FS        |
| R104                    | 42-80-2101           | FXD         | M FILM  | 1K         | OHM | 1% 1/6W | RN1/6FS        |
| R105                    | 40-16-3101           | FXD         | C FILM  | 10K        | OHM | 5% 1/6W | RD1/6FS        |
| R106                    | 42-80-2151           | FXD         | M FILM  | 1.5K       | OHM | 1% 1/6W | RN1/6FS        |
| R107                    | 42-80-2101           | FXD         | M FILM  | 1K         | OHM | 1% 1/6W | RN1/6FS        |
| R108                    | 40-16-2101           | FXD         | C FILM  | 1K         | OHM | 5% 1/6W | RD1/6FS        |
| R109                    | 40-16-1681           | FXD         | C FILM  | 680        | OHM | 5% 1/6W | RD1/6FS        |
| R110                    | 40-16-2121           | FXD         | C FILM  | 1.2K       | OHM | 5% 1/6W | RD1/6FS        |
| R111                    | 40-16-2121           | FXD         | C FILM  | 1.2K       | OHM | 5% 1/6W | RD1/6FS        |
| R112                    | 40-16-1331           | FXD         | C FILM  | 330        | OHM | 5% 1/6W | RD1/6FS        |
| R113                    | 40-16-3221           | FXD         | C FILM  | 22K        | OHM | 5% 1/6W | RD1/6FS        |
| R114                    | 40-16-1821           | FXD         | C FILM  | 820        | OHM | 5% 1/6W | RD1/6FS        |
| R116                    | 40-16-0561           | FXD         | C FILM  | 56         | OHM | 5% 1/6W | RD1/6FS        |
| R117                    | 42-80-1391           | FXD         | M FILM  | 390        | OHM | 1% 1/6W | RN1/6FS        |
| R118                    | 42-80-1391           | FXD         | M FILM  | 390        | OHM | 1% 1/6W | RN1/6FS        |
| R119                    | 42-80-2101           | FXD         | M FILM  | 1K         | OHM | 1% 1/6W | RN1/6FS        |
| R120                    | 42-80-3101           | FXD         | M FILM  | 10K        | OHM | 1% 1/6W | RN1/6FS        |
| R121                    | 42-80-3101           | FXD         | M FILM  | 10K        | OHM | 1% 1/6W | RN1/6FS        |
| R122                    | 42-80-2391           | FXD         | M FILM  | 3.9K       | OHM | 1% 1/6W | RN1/6FS        |
| R123                    | 42-80-2391           | FXD         | M FILM  | 3.9K       | OHM | 1% 1/6W | RN1/6FS        |
| R124                    | 40-16-2331           | FXD         | C FILM  | 3.3K       | OHM | 5% 1/6W | RD1/6FS        |
| R125                    | 40-16-2331           | FXD         | C FILM  | 3.3K       | OHM | 5% 1/6W | RD1/6FS        |
| R126                    | 40-16-1151           | FXD         | C FILM  | 150        | OHM | 5% 1/6W | RD1/6FS        |
| R127                    | 40-16-1151           | FXD         | C FILM  | 150        | OHM | 5% 1/6W | RD1/6FS        |
| R128                    | 40-16-3101           | FXD         | C FILM  | 10K        | OHM | 5% 1/6W | RD1/6FS        |
| R129                    | 40-16-0001           | FXD         | C FILM  | 0          | OHM | 5% 1/6W | RD1/6FS        |
| R130                    | 40-16-2151           | FXD         | C FILM  | 1.5K       | OHM | 5% 1/6W | RD1/6FS        |
| R131                    | 40-16-1681           | FXD         | C FILM  | 680        | OHM | 5% 1/6W | RD1/6FS        |
| R132                    | 40-16-1221           | FXD         | C FILM  | 220        | OHM | 5% 1/6W | RD1/6FS        |
| R133                    | 40-16-0331           | FXD         | C FILM  | 33         | OHM | 5% 1/6W | RD1/6FS        |
| R134                    | 40-16-2181           | FXD         | C FILM  | 1.8K       | OHM | 5% 1/6W | RD1/6FS        |
| R135                    | 40-16-1561           | FXD         | C FILM  | 560        | OHM | 5% 1/6W | RD1/6FS        |
| R136                    | 40-16-1221           | FXD         | C FILM  | 220        | OHM | 5% 1/6W | RD1/6FS        |
| R139                    | 40-16-3101           | FXD         | C FILM  | 10K        | OHM | 5% 1/6W | RD1/6FS        |
| R140                    | 40-16-3101           | FXD         | C FILM  | 10K        | OHM | 5% 1/6W | RD1/6FS        |
| R141                    | 40-16-3101           | FXD         | C FILM  | 10K        | OHM | 5% 1/6W | RD1/6FS        |
| R146                    | 40-16-1561           | FXD         | C FILM  | 560        | OHM | 5% 1/6W | RD1/6FS        |
| R147                    | 40-16-1151           | FXD         | C FILM  | 150        | OHM | 5% 1/6W | RD1/6FS        |
| R148                    | 40-16-1151           | FXD         | C FILM  | 150        | OHM | 5% 1/6W | RD1/6FS        |
| R149                    | 40-16-1151           | FXD         | C FILM  | 150        | OHM | 5% 1/6W | RD1/6FS        |
| R150                    | 40-16-1151           | FXD         | C FILM  | 150        | OHM | 5% 1/6W | RD1/6FS        |
| R152                    | 41-10-2221           | FXD         | M GLAZE | 2.2K       | OHM | 5% 1/8W | CHIP RESI.     |
| R153                    | 41-10-2221           | FXD         | M GLAZE | 2.2K       | OHM | 5% 1/8W | CHIP RESI.     |
| RV1                     | 48-37-1500           | VAR         | M GLAZE | 500        | OHM | B       | TEITSU VM5CKPV |
| RV2                     | 48-37-1200           | VAR         | M GLAZE | 200        | OHM | B       | TEITSU VM5CKPV |
| RV3                     | 48-37-1200           | VAR         | M GLAZE | 200        | OHM | B       | TEITSU VM5CKPV |
| RV4                     | 48-37-1200           | VAR         | M GLAZE | 200        | OHM | B       | TEITSU VM5CKPV |
| RV5                     | 48-37-1200           | VAR         | M GLAZE | 200        | OHM | B       | TEITSU VM5CKPV |
| RV6                     | 48-37-2100           | VAR         | M GLAZE | 1K         | OHM | B       | TEITSU VM5CKPV |
| RV7                     | 48-37-1200           | VAR         | M GLAZE | 200        | OHM | B       | TEITSU VM5CKPV |
| RV8                     | 48-37-2100           | VAR         | M GLAZE | 1K         | OHM | B       | TEITSU VM5CKPV |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                   | 97-11-0021 |            |           |
|-------------------------|----------------------|-------------------------------|------------|------------|-----------|
| RV9                     | 48-37-1200           | VAR M GLAZE 200               | OHM B      | TEITSU     | VM5CKPV   |
| RV10                    | 48-37-2100           | VAR M GLAZE 1K                | OHM B      | TEITSU     | VM5CKPV   |
| RV11                    | 48-37-1200           | VAR M GLAZE 200               | OHM B      | TEITSU     | VM5CKPV   |
| RV12                    | 48-37-2100           | VAR M GLAZE 1K                | OHM B      | TEITSU     | VM5CKPV   |
| RV13                    | 48-37-1200           | VAR M GLAZE 200               | OHM B      | TEITSU     | VM5CKPV   |
| RV14                    | 48-37-3200           | VAR M GLAZE 20K               | OHM B      | TEITSU     | VM5CKPV   |
| RV15                    | 48-37-3200           | VAR M GLAZE 20K               | OHM B      | TEITSU     | VM5CKPV   |
| RV16                    | 48-37-3200           | VAR M GLAZE 20K               | OHM B      | TEITSU     | VM5CKPV   |
| RV17                    | 48-37-3200           | VAR M GLAZE 20K               | OHM B      | TEITSU     | VM5CKPV   |
| RV18                    | 48-37-2100           | VAR M GLAZE 1K                | OHM B      | TEITSU     | VM5CKPV   |
| RV19                    | 48-37-1200           | VAR M GLAZE 200               | OHM B      | TEITSU     | VM5CKPV   |
| RV20                    | 48-37-1100           | VAR M GLAZE 100               | OHM B      | TEITSU     | VM5CKPV   |
| RV21                    | 48-37-2100           | VAR M GLAZE 1K                | OHM B      | TEITSU     | VM5CKPV   |
| RV22                    | 48-37-3100           | VAR M FILM 10K                | OHM B      |            | VM5CKPV   |
| RV23                    | 48-37-1200           | VAR M GLAZE 200               | OHM B      | TEITSU     | VM5CKPV   |
| RV24                    | 48-37-2500           | VAR M GLAZE 5K                | OHM B      | TEITSU     | VM5CKPV   |
| RV25                    | 48-37-1100           | VAR M GLAZE 100               | OHM B      | TEITSU     | VM5CKPV   |
| RV26                    | 48-37-1100           | VAR M GLAZE 100               | OHM B      | TEITSU     | VM5CKPV   |
| RV27                    | 48-37-2100           | VAR M GLAZE 1K                | OHM B      | TEITSU     | VM5CKPV   |
| RV28                    | 48-37-2100           | VAR M GLAZE 1K                | OHM B      | TEITSU     | VM5CKPV   |
| RV29                    | 48-37-1500           | VAR M GLAZE 500               | OHM B      | TEITSU     | VM5CKPV   |
| RV30                    | 48-37-2100           | VAR M GLAZE 1K                | OHM B      | TEITSU     | VM5CKPV   |
| RV31                    | 48-37-2200           | VAR M GLAZE 2K                | OHM B      | TEITSU     | VM5CKPV   |
| RV32                    | 48-37-3200           | VAR M GLAZE 20K               | OHM B      | TEITSU     | VM5CKPV   |
| RV33                    | 48-37-2100           | VAR M GLAZE 1K                | OHM B      | TEITSU     | VM5CKPV   |
| RV34                    | 48-37-1100           | VAR M GLAZE 100               | OHM B      | TEITSU     | VM5CKPV   |
| U1                      | 35-53-0864           | QUAD 2-INPUT EXCLUSIVE-OR     |            | TOSHIBA    | TC74HC86P |
| U2                      | 34-00-0215           | J-FET INPUT OPE-AMP           |            | TEXAS INS. | TL081CP   |
| U3                      | 36-00-1050           | HIC (H5 2ND ATT)              |            | KIKUSUI    | B0209/12  |
| U4                      | 36-00-1050           | HIC (H5 2ND ATT)              |            | KIKUSUI    | B0209/12  |
| U5                      | 35-56-0940           | 8-STAGE SHIHT REGISTER        |            | TOSHIBA    | TC4094BP  |
| U6                      | 35-56-0940           | 8-STAGE SHIHT REGISTER        |            | TOSHIBA    | TC4094BP  |
| U7                      | 35-56-0940           | 8-STAGE SHIHT REGISTER        |            | TOSHIBA    | TC4094BP  |
| U8                      | 35-56-0940           | 8-STAGE SHIHT REGISTER        |            | TOSHIBA    | TC4094BP  |
| U9                      | 35-56-0940           | 8-STAGE SHIHT REGISTER        |            | TOSHIBA    | TC4094BP  |
| U10                     | 35-70-0746           | DUAL D F-F EDGE TRIGGER       |            | TOSHIBA    | TC74HC74P |
| U11                     | 36-00-1060           | HIC (H6 1ST AMP)              |            | KIKUSUI    | B0309/9   |
| U12                     | 36-00-1060           | HIC (H6 1ST AMP)              |            | KIKUSUI    | B0309/9   |
| U13                     | 36-00-1070           | HIC (H7 2ND AMP)              |            | KIKUSUI    | B0409/10  |
| U14                     | 36-00-1070           | HIC (H7 2ND AMP)              |            | KIKUSUI    | B0409/10  |
| U15                     | 36-00-1073           | HIC (H7 2ND AMP CH3/CH4)      |            | KIKUSUI    | B0439/10  |
| U16                     | 36-00-1073           | HIC (H7 2ND AMP CH3/CH4)      |            | KIKUSUI    | B0439/10  |
| U17                     | 36-00-1140           | HIC (H14 ANALOG MPX SP)       |            | KIKUSUI    | B1109/9   |
| U18                     | 36-00-1140           | HIC (H14 ANALOG MPX SP)       |            | KIKUSUI    | B1109/9   |
| U19                     | 36-00-1190           | HIC (H19 SIGNAL OUTPUT AMP)   |            | KIKUSUI    | B1609/12  |
| U20                     | 36-00-1080           | HIC (H8 VERT MODE SWITCH)     |            | KIKUSUI    | B0509/4   |
| U21                     | 36-00-1420           | HIC (H42 DVM TRUE RMS CONV.)  |            | KIKUSUI    | B3809/6   |
| U22                     | 36-00-1430           | HIC (H43 DVM PEAK DETECTOR)   |            | KIKUSUI    | B3909/6   |
| U23                     | 34-00-0210           | FET OPE-AMP                   |            | TEXAS INS. | TL084CN   |
| U24                     | 34-69-0030           | TRIPLE 2-CHANNEL MULTIPLEXER  |            | TOSHIBA    | TC4053BP  |
| U25                     | 36-00-1090           | HIC (H9 DELAY LINE DRIVER)    |            | KIKUSUI    | B0609/6   |
| U27                     | 36-00-1210           | HIC (H21 TRIG SOUCE SWITCHI)  |            | KIKUSUI    | B1709/6   |
| U28                     | 36-00-1220           | HIC (H22 TRIG COUPLE SWITCHI) |            | KIKUSUI    | B1809/12  |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                     | 97-11-0021 |            |
|-------------------------|----------------------|---------------------------------|------------|------------|
| U29                     | 36-00-1220           | HIC (H22 TRIG COUPLE SWITCH)    | KIKUSUI    | B1809/12   |
| U30                     | 36-00-1230           | HIC (H23 TRIG LEVEL COMP.)      | KIKUSUI    | B1909/9    |
| U31                     | 36-00-1230           | HIC (H23 TRIG LEVEL COMP.)      | KIKUSUI    | B1909/9    |
| U32                     | 36-00-1240           | HIC (H24 TV SYNC SEPRATOR)      | KIKUSUI    | B2009/12   |
| U33                     | 35-53-1584           | QUAD 2-TO-1 DATA SELECTOR (INV) | TOSHIBA    | TC74HC158P |
| U34                     | 35-53-1584           | QUAD 2-TO-1 DATA SELECTOR (INV) | TOSHIBA    | TC74HC158P |
| U35                     | 35-56-0940           | 8-STAGE SHIHT REGISTER          | TOSHIBA    | TC4094BP   |
| U36                     | 35-56-0940           | 8-STAGE SHIHT REGISTER          | TOSHIBA    | TC4094BP   |
| U37                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER      | TOSHIBA    | TC74HC4094 |
| U38                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER      | TOSHIBA    | TC74HC4094 |
| U39                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER      | TOSHIBA    | TC74HC4094 |
| U40                     | 35-56-0940           | 8-STAGE SHIHT REGISTER          | TOSHIBA    | TC4094BP   |
| U41                     | 35-56-0940           | 8-STAGE SHIHT REGISTER          | TOSHIBA    | TC4094BP   |
| U42                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER      | TOSHIBA    | TC74HC4094 |
| U43                     | 36-00-1270           | HIC (H27 SWEEP GENERATOR)       | KIKUSUI    | B2309/6    |
| U44                     | 36-00-1270           | HIC (H27 SWEEP GENERATOR)       | KIKUSUI    | B2309/6    |
| U45                     | 34-90-0051           | REGULATOR                       | TEXAS INS. | TL431CLPB  |
| U46                     | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS      | TOSHIBA    | TC74HC157P |
| U47                     | 35-56-0525           | DUAL 4CH ANALOG MPX             | MATSUSITA  | MN74HC4052 |
| U48                     | 36-00-1250           | HIC (H25 SWEEP CONTROLLER)      | KIKUSUI    | B2109/3    |
| U49                     | 35-53-0144           | HEX SHMITT-TRIG INVERTER        | TOSHIBA    | TC74HC14P  |
| U50                     | 34-90-0051           | REGULATOR                       | TEXAS INS. | TL431CLPB  |
| U51                     | 34-00-0090           | OPE-AMP                         | NEC        | UPC741C    |
| U52                     | 36-00-1290           | HIC (H29 SWEEP & COMP. SWITCH)  | KIKUSUI    | B2509/6    |
| U53                     | 35-70-0006           | QUAD 2-INPUT POSI-NAND          | TOSHIBA    | TC74HC00P  |
| U54                     | 35-70-0006           | QUAD 2-INPUT POSI-NAND          | TOSHIBA    | TC74HC00P  |
| U55                     | 36-00-1300           | HIC (H30 HORIZ SW. & DRIVER)    | KIKUSUI    | B2609/6    |
| U56                     | 36-00-1280           | HIC (H28 DELAY TIME COMP.)      | KIKUSUI    | B2409/9    |
| U57                     | 36-00-1340           | HIC (H34 Z-AXIS SW. & DRIVER)   | KIKUSUI    | B3009/6    |
| U58                     | 36-00-1260           | HIC (H26 PRESCALER)             | KIKUSUI    | B2209/12   |
| U59                     | 36-00-1410           | HIC (H41 SEQUENCE CONT.)        | KIKUSUI    | B3709/4    |
| U60                     | 35-56-0280           | BCD TO DECIMAL DECODER          | TOSHIBA    | TC4028BP   |
| U61                     | 35-56-0280           | BCD TO DECIMAL DECODER          | TOSHIBA    | TC4028BP   |
| U62                     | 35-53-1254           | QUAD BUS BUFFER GATES (3-ST)    | TOSHIBA    | TC74HC125P |
| U63                     | 35-56-0940           | 8-STAGE SHIHT REGISTER          | TOSHIBA    | TC4094BP   |
| U64                     | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER      | TOSHIBA    | TC74HC4094 |
| U65                     | 36-00-1140           | HIC (H14 ANALOG MPX SP)         | KIKUSUI    | B1109/9    |
| U66                     | 36-00-1140           | HIC (H14 ANALOG MPX SP)         | KIKUSUI    | B1109/9    |
| U67                     | 35-70-0048           | HEX INVERTERS                   | TOSHIBA    | TC74HC04P  |

|            |           |             |            |
|------------|-----------|-------------|------------|
| REFERENCE  | KIKUSUI   |             |            |
| DESIGNATOR | PARTS NO. | DESCRIPTION | 97-11-0030 |

# A5 ASSEMBLY

|     |            |                        |                    |         |
|-----|------------|------------------------|--------------------|---------|
| C3  | 52-06-2165 | FXD CER 33PF           | 10% 500V TYPE1     |         |
| C4  | 52-06-2215 | FXD CER 82PF           | 10% 500V TYPE1     |         |
| C5  | 50-67-0040 | FXD PLSTC FILM         | 0.022MF 10% 100WV  |         |
| C6  | 50-67-0000 | FXD PLSTC FILM         | 0.001MF 10% 100WV  |         |
| C8  | 52-06-2225 | FXD CER 100PF          | 10% 50V TYPE1      |         |
| C9  | 52-06-2225 | FXD CER 100PF          | 10% 50V TYPE1      |         |
| C11 | 52-06-2184 | FXD CER 47PF           | 10% 50V TYPE1      |         |
| C12 | 52-06-2184 | FXD CER 47PF           | 10% 50V TYPE1      |         |
| C13 | 54-40-1200 | FXD ELECT 10MF         | 50WV               |         |
| C14 | 54-40-1200 | FXD ELECT 10MF         | 50WV               |         |
| C15 | 52-03-3469 | FXD CER 0.01UF         | +100-0% 500V TYPE2 |         |
| C16 | 52-03-3469 | FXD CER 0.01UF         | +100-0% 500V TYPE2 |         |
| C21 | 54-40-1200 | FXD ELECT 10MF         | 50WV               |         |
| C22 | 54-70-1080 | FXD ELECT 2.2MF        | 250WV              |         |
| C23 | 52-03-3469 | FXD CER 0.01UF         | +100-0% 500V TYPE2 |         |
| C24 | 50-77-3500 | FXD PLSTC FILM         | 0.047MF 20% 250WV  |         |
| C25 | 54-30-1960 | FXD ELECT 47MF         | 25WV               |         |
| C26 | 52-03-3469 | FXD CER 0.01UF         | +100-0% 500V TYPE2 |         |
| C27 | 50-77-3500 | FXD PLSTC FILM         | 0.047MF 20% 250WV  |         |
| C28 | 54-40-1200 | FXD ELECT 10MF         | 50WV               |         |
| C29 | 52-06-2225 | FXD CER 100PF          | 10% 50V TYPE1      |         |
| C30 | 52-06-2225 | FXD CER 100PF          | 10% 50V TYPE1      |         |
| C33 | 52-06-2184 | FXD CER 47PF           | 10% 50V TYPE1      |         |
| C34 | 52-01-2345 | FXD CER 1000PF         | 10% 50V TYPE2      |         |
| C35 | 52-06-3102 | FXD CER 10PF           | 10% 500V TYPE1     |         |
| C36 | 52-06-2285 | FXD CER 330PF          | 10% 50V TYPE1      |         |
| CR1 | 32-30-1200 | DIODE VR=60V IO=1A     | HITACHI 1SS120     |         |
| CR2 | 32-30-1200 | DIODE VR=60V IO=1A     | HITACHI 1SS120     |         |
| CV1 | 57-10-1203 | VAR CER 5-20PF         |                    |         |
| CV2 | 57-10-1223 | VAR CER 8-50PF         |                    |         |
| CV3 | 57-10-1223 | VAR CER 8-50PF         |                    |         |
| CV5 | 57-10-1223 | VAR CER 8-50PF         |                    |         |
| L1  | 67-05-0000 | INDUCTOR L-2868        |                    |         |
| L2  | 67-05-0000 | INDUCTOR L-2868        |                    |         |
| Q1  | 30-10-8441 | TR SI PNP              | HITACHI 2SA844-D   |         |
| Q2  | 30-33-5961 | TR SI NPN (80V 0.3A W) | 2SC3596-D          |         |
| Q3  | 30-33-5961 | TR SI NPN (80V 0.3A W) | 2SC3596-D          |         |
| Q4  | 30-31-9071 | TR SI NPN              | HITACHI 2SC1907    |         |
| Q5  | 30-31-9071 | TR SI NPN              | HITACHI 2SC1907    |         |
| Q6  | 30-31-9071 | TR SI NPN              | HITACHI 2SC1907    |         |
| R1  | 42-80-0911 | FXD M FILM 91          | OHM 1% 1/6W        | RN1/6FS |
| R2  | 42-80-0911 | FXD M FILM 91          | OHM 1% 1/6W        | RN1/6FS |
| R4  | 40-16-1121 | FXD C FILM 120         | OHM 5% 1/6W        | RD1/6FS |
| R5  | 40-16-3121 | FXD C FILM 12K         | OHM 5% 1/6W        | RD1/6FS |
| R6  | 40-16-2561 | FXD C FILM 5.6K        | OHM 5% 1/6W        | RD1/6FS |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                 | 97-11-0030  |                    |
|-------------------------|----------------------|-----------------------------|-------------|--------------------|
| R7                      | 40-16-2101           | FXD C FILM 1K               | OHM 5% 1/6W | RD1/6FS            |
| R8                      | 42-80-2271           | FXD M FILM 2.7K             | OHM 1% 1/6W | RN1/6FS            |
| R9                      | 42-80-2271           | FXD M FILM 2.7K             | OHM 1% 1/6W | RN1/6FS            |
| R10                     | 42-80-2681           | FXD M FILM 6.8K             | OHM 1% 1/6W | RN1/6FS            |
| R11                     | 42-80-2681           | FXD M FILM 6.8K             | OHM 1% 1/6W | RN1/6FS            |
| R12                     | 40-16-1101           | FXD C FILM 100              | OHM 5% 1/6W | RD1/6FS            |
| R13                     | 40-16-0181           | FXD C FILM 18               | OHM 5% 1/6W | RD1/6FS            |
| R14                     | 40-16-0181           | FXD C FILM 18               | OHM 5% 1/6W | RD1/6FS            |
| R15                     | 40-16-0101           | FXD C FILM 10               | OHM 5% 1/6W | RD1/6FS            |
| R16                     | 40-16-0101           | FXD C FILM 10               | OHM 5% 1/6W | RD1/6FS            |
| R21                     | 40-16-2271           | FXD C FILM 2.7K             | OHM 5% 1/6W | RD1/6FS            |
| R22                     | 40-16-3101           | FXD C FILM 10K              | OHM 5% 1/6W | RD1/6FS            |
| R23                     | 40-16-1391           | FXD C FILM 390              | OHM 5% 1/6W | RD1/6FS            |
| R24                     | 40-16-0331           | FXD C FILM 33               | OHM 5% 1/6W | RD1/6FS            |
| R25                     | 40-16-0331           | FXD C FILM 33               | OHM 5% 1/6W | RD1/6FS            |
| R26                     | 38-00-0070           | THERMISTOR 200              | OHM         | TOSHIBA D22A       |
| R41                     | 44-57-0550           | FXD M FILM 220              | OHM 5% 3W   | ERG3SJ             |
| R42                     | 44-57-0550           | FXD M FILM 220              | OHM 5% 3W   | ERG3SJ             |
| R43                     | 44-57-0550           | FXD M FILM 220              | OHM 5% 3W   | ERG3SJ             |
| R44                     | 44-57-0550           | FXD M FILM 220              | OHM 5% 3W   | ERG3SJ             |
| R45                     | 40-27-0102           | FXD C FILM 10               | OHM 5% 1/4W | NAS1/4S            |
| R51                     | 40-16-1101           | FXD C FILM 100              | OHM 5% 1/6W | RD1/6FS            |
| R52                     | 40-16-2561           | FXD C FILM 5.6K             | OHM 5% 1/6W | RD1/6FS            |
| R53                     | 40-16-1331           | FXD C FILM 330              | OHM 5% 1/6W | RD1/6FS            |
| R54                     | 40-16-2561           | FXD C FILM 5.6K             | OHM 5% 1/6W | RD1/6FS            |
| R55                     | 40-16-2101           | FXD C FILM 1K               | OHM 5% 1/6W | RD1/6FS            |
| R61                     | 40-16-2101           | FXD C FILM 1K               | OHM 5% 1/6W | RD1/6FS            |
| R62                     | 40-16-2101           | FXD C FILM 1K               | OHM 5% 1/6W | RD1/6FS            |
| R63                     | 40-16-1471           | FXD C FILM 470              | OHM 5% 1/6W | RD1/6FS            |
| R64                     | 40-16-2221           | FXD C FILM 2.2K             | OHM 5% 1/6W | RD1/6FS            |
| R65                     | 40-16-0101           | FXD C FILM 10               | OHM 5% 1/6W | RD1/6FS            |
| R67                     | 40-16-4391           | FXD C FILM 390K             | OHM 5% 1/6W | RD1/6FS            |
| R68                     | 40-16-2471           | FXD C FILM 4.7K             | OHM 5% 1/6W | RD1/6FS            |
| R69                     | 40-16-2101           | FXD C FILM 1K               | OHM 5% 1/6W | RD1/6FS            |
| R70                     | 38-00-0070           | THERMISTOR 200              | OHM         | TOSHIBA D22A       |
| RV1                     | 48-37-1100           | VAR M GLAZE 100             | OHM B       | TEITSU VM5CKPV     |
| RV2                     | 48-37-1100           | VAR M GLAZE 100             | OHM B       | TEITSU VM5CKPV     |
| RV3                     | 48-37-1200           | VAR M GLAZE 200             | OHM B       | TEITSU VM5CKPV     |
| RV4                     | 48-37-1100           | VAR M GLAZE 100             | OHM B       | TEITSU VM5CKPV     |
| RV5                     | 48-37-2500           | VAR M GLAZE 5K              | OHM B       | TEITSU VM5CKPV     |
| RV6                     | 48-37-2200           | VAR M GLAZE 2K              | OHM B       | TEITSU VM5CKPV     |
| RV7                     | 48-37-1500           | VAR M GLAZE 500             | OHM B       | TEITSU VM5CKPV     |
| RV8                     | 48-37-3200           | VAR M GLAZE 20K             | OHM B       | TEITSU VM5CKPV     |
| U1                      | 34-00-0215           | J-FET INPUT OPE-AMP         |             | TEXAS INS. TL081CP |
| U2                      | 36-00-1100           | HIC (H10 VERT FINAL DRIVER) |             | KIKUSUI B0709/6    |
| U3                      | 36-00-1310           | HIC (H31 HORIZ FINAL AMP)   |             | KIKUSUI B2709/6    |



REFERENCE KIKUSUI  
DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0040

A6 ASSEMBLY

|      |            |                            |            |              |          |
|------|------------|----------------------------|------------|--------------|----------|
| C2   | 54-40-1200 | FXD ELECT 10MF             | 50VV       |              |          |
| C4   | 54-40-1200 | FXD ELECT 10MF             | 50VV       |              |          |
| C5   | 52-03-3469 | FXD CER 0.01UF             | +100-0%    | 500V TYPE2   |          |
| C6   | 50-77-3500 | FXD PLSTC FILM             | 0.047MF    | 20% 250VV    |          |
| C7   | 54-30-1970 | FXD ELECT 100MF            | 25VV       |              |          |
| C8   | 52-03-3469 | FXD CER 0.01UF             | +100-0%    | 500V TYPE2   |          |
| C9   | 50-77-3500 | FXD PLSTC FILM             | 0.047MF    | 20% 250VV    |          |
| C10  | 55-37-2050 | FXD TANT ELECT             | 1UF        | 35V          |          |
| C11  | 52-01-2425 | FXD CER 4700PF             | 10%        | 50V TYPE2    |          |
| C12  | 50-67-0040 | FXD PLSTC FILM             | 0.022MF    | 10% 100VV    |          |
| C13  | 50-67-0030 | FXD PLSTC FILM             | 0.01MF     | 10% 100VV    |          |
| C14  | 54-30-1960 | FXD ELECT 47MF             | 25VV       |              |          |
| C15  | 54-30-1970 | FXD ELECT 100MF            | 25VV       |              |          |
| C16  | 52-96-1170 | FXD CER 5PF                | 1KV        |              |          |
| C17  | 52-98-1020 | FXD CER 1000PF             | +80 - -20% | 3.15KV       |          |
| C18  | 52-98-1020 | FXD CER 1000PF             | +80 - -20% | 3.15KV       |          |
| C19  | 52-03-3469 | FXD CER 0.01UF             | +100-0%    | 500V TYPE2   |          |
| C20  | 52-98-1000 | FXD CER 4700PF             | +80-20%    | 3.15KV TYPE1 |          |
| C21  | 52-98-1020 | FXD CER 1000PF             | +80 - -20% | 3.15KV       |          |
| C22  | 52-98-1020 | FXD CER 1000PF             | +80 - -20% | 3.15KV       |          |
| C23  | 52-96-1170 | FXD CER 5PF                | 1KV        |              |          |
| C24  | 52-98-1020 | FXD CER 1000PF             | +80 - -20% | 3.15KV       |          |
| C25  | 52-03-3469 | FXD CER 0.01UF             | +100-0%    | 500V TYPE2   |          |
| C26  | 52-98-1000 | FXD CER 4700PF             | +80-20%    | 3.15KV TYPE1 |          |
| C27  | 52-98-1000 | FXD CER 4700PF             | +80-20%    | 3.15KV TYPE1 |          |
| C28  | 52-98-1000 | FXD CER 4700PF             | +80-20%    | 3.15KV TYPE1 |          |
| C29  | 52-98-1000 | FXD CER 4700PF             | +80-20%    | 3.15KV TYPE1 |          |
| C30  | 52-03-3469 | FXD CER 0.01UF             | +100-0%    | 500V TYPE2   |          |
| C31  | 52-03-3469 | FXD CER 0.01UF             | +100-0%    | 500V TYPE2   |          |
| C32  | 52-03-3469 | FXD CER 0.01UF             | +100-0%    | 500V TYPE2   |          |
| C36  | 52-03-3469 | FXD CER 0.01UF             | +100-0%    | 500V TYPE2   |          |
| CR1  | 32-30-1200 | DIODE VR=60V               | IO=1A      | HITACHI      | 1SS120   |
| CR2  | 32-30-1200 | DIODE VR=60V               | IO=1A      | HITACHI      | 1SS120   |
| CR3  | 32-30-1200 | DIODE VR=60V               | IO=1A      | HITACHI      | 1SS120   |
| CR4  | 32-30-1200 | DIODE VR=60V               | IO=1A      | HITACHI      | 1SS120   |
| CR5  | 32-30-1200 | DIODE VR=60V               | IO=1A      | HITACHI      | 1SS120   |
| CR6  | 32-30-1200 | DIODE VR=60V               | IO=1A      | HITACHI      | 1SS120   |
| CR7  | 32-91-2310 | ZENER VZ= 90 - 110V        | P=1W       | TOSHIBA      | 1Z100    |
| CR8  | 32-90-3130 | DIODE VR=250V              | IO=0.2A    | MATSUSITA    | MA185    |
| CR9  | 32-90-3130 | DIODE VR=250V              | IO=0.2A    | MATSUSITA    | MA185    |
| CR10 | 32-90-3130 | DIODE VR=250V              | IO=0.2A    | MATSUSITA    | MA185    |
| CR11 | 32-90-1820 | DIODE VR=2KV FAST RECOVERY |            | HITACHI      | ERB26-20 |
| CR12 | 32-90-3130 | DIODE VR=250V              | IO=0.2A    | MATSUSITA    | MA185    |
| CR13 | 32-90-3130 | DIODE VR=250V              | IO=0.2A    | MATSUSITA    | MA185    |
| CR14 | 32-90-3130 | DIODE VR=250V              | IO=0.2A    | MATSUSITA    | MA185    |
| CR15 | 32-90-1820 | DIODE VR=2KV FAST RECOVERY |            | HITACHI      | ERB26-20 |
| CR16 | 32-90-0523 | DIODE VR=600V              | IO=1A      | TOSHIBA      | S5277J   |
| CR17 | 32-90-0523 | DIODE VR=600V              | IO=1A      | TOSHIBA      | S5277J   |

DS1 23-70-0100 LAMP NEON



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION               | 97-11-0040  |           |           |
|-------------------------|----------------------|---------------------------|-------------|-----------|-----------|
| DS2                     | 23-70-0100           | LAMP NEON                 |             |           |           |
| DS3                     | 23-70-0100           | LAMP NEON                 |             |           |           |
| L1                      | 67-10-0890           | INDUCTOR 100MH 10%        |             |           |           |
| Q1                      | 30-31-9071           | TR SI NPN                 |             | HITACHI   | 2SC1907   |
| Q2                      | 30-41-4060           | TR SI NPN (60V 3A 25W)    |             | TOSHIBA   | 2SD1406-Y |
| Q3                      | 30-32-7041           | TR SI NPN                 |             | TOSHIBA   | 2SC2704-0 |
| Q4                      | 30-32-7041           | TR SI NPN                 |             | TOSHIBA   | 2SC2704-0 |
| R1                      | 40-16-0471           | FXD C FILM 47             | OHM 5% 1/6W |           | RD1/6FS   |
| R2                      | 40-16-2101           | FXD C FILM 1K             | OHM 5% 1/6W |           | RD1/6FS   |
| R3                      | 40-16-2101           | FXD C FILM 1K             | OHM 5% 1/6W |           | RD1/6FS   |
| R4                      | 40-16-1221           | FXD C FILM 220            | OHM 5% 1/6W |           | RD1/6FS   |
| R5                      | 40-16-3101           | FXD C FILM 10K            | OHM 5% 1/6W |           | RD1/6FS   |
| R6                      | 40-16-1391           | FXD C FILM 390            | OHM 5% 1/6W |           | RD1/6FS   |
| R7                      | 40-16-1221           | FXD C FILM 220            | OHM 5% 1/6W |           | RD1/6FS   |
| R9                      | 42-80-3101           | FXD M FILM 10K            | OHM 1% 1/6W |           | RN1/6FS   |
| R10                     | 42-80-2271           | FXD M FILM 2.7K           | OHM 1% 1/6W |           | RN1/6FS   |
| R11                     | 42-80-3821           | FXD M FILM 82K            | OHM 1% 1/6W |           | RN1/6FS   |
| R13                     | 40-16-2151           | FXD C FILM 1.5K           | OHM 5% 1/6W |           | RD1/6FS   |
| R14                     | 40-16-1271           | FXD C FILM 270            | OHM 5% 1/6W |           | RD1/6FS   |
| R15                     | 40-16-0001           | FXD C FILM 0              | OHM 5% 1/6W |           | RD1/6FS   |
| R16                     | 40-16-3681           | FXD C FILM 68K            | OHM 5% 1/6W |           | RD1/6FS   |
| R17                     | 40-16-2181           | FXD C FILM 1.8K           | OHM 5% 1/6W |           | RD1/6FS   |
| R18                     | 40-16-2101           | FXD C FILM 1K             | OHM 5% 1/6W |           | RD1/6FS   |
| R19                     | 40-16-0331           | FXD C FILM 33             | OHM 5% 1/6W |           | RD1/6FS   |
| R20                     | 40-16-3561           | FXD C FILM 56K            | OHM 5% 1/6W |           | RD1/6FS   |
| R21                     | 40-16-3181           | FXD C FILM 18K            | OHM 5% 1/6W |           | RD1/6FS   |
| R22                     | 44-91-8101           | FXD M OXIDE 1             | OHM 5% 1W   | MATSUSITA | ERX1ANJ   |
| R23                     | 40-27-3472           | FXD C FILM 47K            | OHM 5% 1/4W |           |           |
| R24                     | 40-27-4152           | FXD C FILM 150K           | OHM 5% 1/4W |           |           |
| R25                     | 40-37-6101           | FXD C FILM 10M            | OHM 5% 1/2W |           |           |
| R26                     | 40-37-6101           | FXD C FILM 10M            | OHM 5% 1/2W |           |           |
| R27                     | 40-27-2332           | FXD C FILM 3.3K           | OHM 5% 1/4W |           |           |
| R28                     | 40-37-5221           | FXD C FILM 2.2M           | OHM 5% 1/2W |           |           |
| R29                     | 40-37-6101           | FXD C FILM 10M            | OHM 5% 1/2W |           |           |
| R30                     | 40-37-6101           | FXD C FILM 10M            | OHM 5% 1/2W |           |           |
| R31                     | 40-27-2102           | FXD C FILM 1K             | OHM 5% 1/4W |           | NAS1/4S   |
| R32                     | 40-27-3822           | FXD C FILM 82K            | OHM 5% 1/4W |           |           |
| R33                     | 42-44-0330           | FXD T FILM 10M            | OHM 1% 1W   |           |           |
| R34                     | 42-34-2190           | FXD M GLAZE 6.8M          | OHM 1% 0.8W |           |           |
| R35                     | 40-27-4472           | FXD C FILM 470K           | OHM 5% 1/4W |           |           |
| R36                     | 40-27-3222           | FXD C FILM 22K            | OHM 5% 1/4W |           |           |
| R37                     | 40-27-4222           | FXD C FILM 220K           | OHM 5% 1/4W |           |           |
| R42                     | 40-16-2561           | FXD C FILM 5.6K           | OHM 5% 1/6W |           | RD1/6FS   |
| R43                     | 40-16-0331           | FXD C FILM 33             | OHM 5% 1/6W |           | RD1/6FS   |
| RV2                     | 48-31-3500           | FXD M GLAZE 50K           | OHM B PH    |           |           |
| RV3                     | 48-26-5221           | VAR M GLAZE 2.2M          | OHM         |           |           |
| RV4                     | 48-31-4100           | VAR M GLAZE 100K          | OHM B PH    |           |           |
| RV5                     | 48-31-4100           | VAR M GLAZE 100K          | OHM B PH    |           |           |
| RV6                     | 48-31-4100           | VAR M GLAZE 100K          | OHM B PH    |           |           |
| U601                    | 36-00-1310           | HIC (H31 HORIZ FINAL AMP) |             | KIKUSUI   | B2709/6   |

| REFERENCE<br>SIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                      | 97-11-0040 |                   |
|-----------------------|----------------------|----------------------------------|------------|-------------------|
| 602                   | 34-00-0340           | FET INPUT DUAL OP AMP            |            | TEXAS INS.TL082CP |
| 7 ASSEMBLY            |                      |                                  |            |                   |
| 1                     | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |            |                   |
| 2                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |                   |
| 3                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |                   |
| 4                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |                   |
| 5                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |                   |
| 6                     | 54-20-1210           | FXD ELECT 220MF 16VV             |            | KME16VB220        |
| 7                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |                   |
| 8                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |            |                   |
| CR1                   | 37-00-0440           | LAMP LED RED                     | TOSHIBA    | TLUY163           |
| CR2                   | 37-00-0440           | LAMP LED RED                     | TOSHIBA    | TLUY163           |
| CR3                   | 37-00-0440           | LAMP LED RED                     | TOSHIBA    | TLUY163           |
| OS1                   | 23-43-0000           | LAMP FILAMENT 14V 40MA           |            | RM314V40          |
| OS2                   | 23-43-0000           | LAMP FILAMENT 14V 40MA           |            | RM314V40          |
| OS3                   | 23-43-0000           | LAMP FILAMENT 14V 40MA           |            | RM314V40          |
| Q1                    | 30-11-0151           | TR SI PNP                        | TOSHIBA    | 2SA1015-Y         |
| Q2                    | 30-30-9451           | TR SI NPN                        | NEC        | 2SC945-Q          |
| Q3                    | 30-31-8461           | TR SI NPN                        | MATSUSITA  | 2SC1846-R         |
| Q4                    | 30-31-8461           | TR SI NPN                        | MATSUSITA  | 2SC1846-R         |
| Q5                    | 30-30-9451           | TR SI NPN                        | NEC        | 2SC945-Q          |
| Q6                    | 30-11-0151           | TR SI PNP                        | TOSHIBA    | 2SA1015-Y         |
| R1                    | 42-80-2681           | FXD M FILM 6.8K OHM 1% 1/6W      |            | RN1/6FS           |
| R2                    | 42-80-2331           | FXD M FILM 3.3K OHM 1% 1/6W      |            | RN1/6FS           |
| R3                    | 40-16-1101           | FXD C FILM 100 OHM 5% 1/6W       |            | RD1/6FS           |
| R4                    | 42-80-3101           | FXD M FILM 10K OHM 1% 1/6W       |            | RN1/6FS           |
| R5                    | 42-80-3101           | FXD M FILM 10K OHM 1% 1/6W       |            | RN1/6FS           |
| R6                    | 40-16-1101           | FXD C FILM 100 OHM 5% 1/6W       |            | RD1/6FS           |
| R7                    | 40-16-2821           | FXD C FILM 8.2K OHM 5% 1/6W      |            | RD1/6FS           |
| R8                    | 40-16-2391           | FXD C FILM 3.9K OHM 5% 1/6W      |            | RD1/6FS           |
| R9                    | 40-16-2391           | FXD C FILM 3.9K OHM 5% 1/6W      |            | RD1/6FS           |
| R10                   | 40-16-1101           | FXD C FILM 100 OHM 5% 1/6W       |            | RD1/6FS           |
| R11                   | 40-16-2221           | FXD C FILM 2.2K OHM 5% 1/6W      |            | RD1/6FS           |
| R12                   | 40-16-4101           | FXD C FILM 100K OHM 5% 1/6W      |            | RD1/6FS           |
| R14                   | 40-16-2471           | FXD C FILM 4.7K OHM 5% 1/6W      |            | RD1/6FS           |
| R15                   | 40-16-2101           | FXD C FILM 1K OHM 5% 1/6W        |            | RD1/6FS           |
| R16                   | 40-16-2101           | FXD C FILM 1K OHM 5% 1/6W        |            | RD1/6FS           |
| R17                   | 40-16-2101           | FXD C FILM 1K OHM 5% 1/6W        |            | RD1/6FS           |
| R18                   | 40-16-3101           | FXD C FILM 10K OHM 5% 1/6W       |            | RD1/6FS           |
| RV1                   | 45-01-0810           | VAR C COMP 20K/20K OHM B         | KIKUSUI    | V12LG3S           |
| RV2                   | 45-02-0280           | VAR C COMP 20K/20K OHM B         | KIKUSUI    | V12LG3N           |
| RV3                   | 45-02-0285           | VAR C COMP 20K/20K OHM B         |            | V12LG3N           |
| RV4                   | 45-01-0810           | VAR C COMP 20K/20K OHM B         | KIKUSUI    | V12LG3S           |
| S1                    | 81-01-0270           | PUSH SWITCH                      | ALPS       | SDG5P-E           |
| U1                    | 34-00-0240           | DUAL OPE-AMP                     | NEC        | UPC4558C          |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                      | 97-11-0050        |
|-------------------------|----------------------|----------------------------------|-------------------|
| U2                      | 34-00-0340           | FET INPUT DUAL OP AMP            | TEXAS INS.TL082CP |
| A8 ASSEMBLY             |                      |                                  | 97-11-0060        |
| BT1                     | 94-00-0200           | BATTERY LITHIUM                  | CR14250P31        |
| C1                      | 52-06-3165           | FXD CER 33PF 10% 500V TYPE1      |                   |
| C2                      | 52-06-3165           | FXD CER 33PF 10% 500V TYPE1      |                   |
| C3                      | 55-37-2050           | FXD TANT ELECT 1UF 35V           |                   |
| C4                      | 52-05-2468           | FXD CER 0.01UF +80-20% 50V TYPE2 |                   |
| C6                      | 54-20-1210           | FXD ELECT 220MF 16WV             | KME16VB220        |
| C7                      | 54-20-1210           | FXD ELECT 220MF 16WV             | KME16VB220        |
| C8                      | 52-06-2102           | FXD CER 10P 10% 50V TYPE1        |                   |
| C9                      | 52-01-3305           | FXD CER 470PF 10% 500V TYPE2     |                   |
| C10                     | 52-06-2225           | FXD CER 100PF 10% 50V TYPE1      |                   |
| C11                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C12                     | 52-06-2225           | FXD CER 100PF 10% 50V TYPE1      |                   |
| C14                     | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |                   |
| C15                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C16                     | 52-06-2225           | FXD CER 100PF 10% 50V TYPE1      |                   |
| C18                     | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |                   |
| C21                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C22                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C23                     | 52-01-2345           | FXD CER 1000PF 10% 50V TYPE2     |                   |
| C24                     | 52-06-3165           | FXD CER 33PF 10% 500V TYPE1      |                   |
| C25                     | 52-06-3165           | FXD CER 33PF 10% 500V TYPE1      |                   |
| C26                     | 54-20-1210           | FXD ELECT 220MF 16WV             | KME16VB220        |
| C27                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C28                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C29                     | 54-20-1210           | FXD ELECT 220MF 16WV             | KME16VB220        |
| C30                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C31                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C32                     | 54-40-1200           | FXD ELECT 10MF 50WV              |                   |
| C33                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C34                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C35                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C36                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C37                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C38                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C39                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C40                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C41                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C42                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C43                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C44                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C45                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C46                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C47                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C48                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C49                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C51                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C52                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C53                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |
| C54                     | 52-37-1000           | FXD CER 0.047UF 20% 25V TYPE1    |                   |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION  |               |        |           | 97-11-0060 |
|-------------------------|----------------------|--------------|---------------|--------|-----------|------------|
| C55                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C56                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C57                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C58                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C59                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C61                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C62                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C63                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C64                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C65                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C66                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C67                     | 52-37-1000           | FXD CER      | 0.047UF       | 20%    | 25V TYPE1 |            |
| C68                     | 52-06-2225           | FXD CER      | 100PF         | 10%    | 50V TYPE1 |            |
| C69                     | 52-06-2225           | FXD CER      | 100PF         | 10%    | 50V TYPE1 |            |
| C70                     | 52-06-2184           | FXD CER      | 47PF          | 10%    | 50V TYPE1 |            |
| CR1                     | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR2                     | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR3                     | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR4                     | 32-92-0033           | ZENER VZ=3.2 | - 3.4V        |        | HITACHI   | HZ3C-2     |
| CR5                     | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR6                     | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR7                     | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR8                     | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR9                     | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR10                    | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR11                    | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR12                    | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR13                    | 32-30-1200           | DIODE VR=60V | IO=1A         |        | HITACHI   | 1SS120     |
| CR14                    | 32-92-0056           | ZENER VZ=5.5 | - 5.8V P=0.4W |        | NEC       | RD5.6JB2   |
| Q1                      | 30-11-0151           | TR SI PNP    |               |        | TOSHIBA   | 2SA1015-Y  |
| Q2                      | 30-30-9451           | TR SI NPN    |               |        | NEC       | 2SC945-Q   |
| Q3                      | 30-11-0151           | TR SI PNP    |               |        | TOSHIBA   | 2SA1015-Y  |
| Q4                      | 30-11-0051           | TR SI PNP    |               |        | NEC       | 2SA1005-L  |
| Q5                      | 30-11-0051           | TR SI PNP    |               |        | NEC       | 2SA1005-L  |
| Q6                      | 30-30-9451           | TR SI NPN    |               |        | NEC       | 2SC945-Q   |
| Q7                      | 30-11-0151           | TR SI PNP    |               |        | TOSHIBA   | 2SA1015-Y  |
| R1                      | 40-16-5101           | FXD C FILM   | 1M            | OHM 5% | 1/6W      | RD1/6FS    |
| R2                      | 40-16-2331           | FXD C FILM   | 3.3K          | OHM 5% | 1/6W      | RD1/6FS    |
| R3                      | 40-16-2561           | FXD C FILM   | 5.6K          | OHM 5% | 1/6W      | RD1/6FS    |
| R4                      | 40-16-0101           | FXD C FILM   | 10            | OHM 5% | 1/6W      | RD1/6FS    |
| R5                      | 40-16-1821           | FXD C FILM   | 820           | OHM 5% | 1/6W      | RD1/6FS    |
| R6                      | 42-80-3471           | FXD M FILM   | 47K           | OHM 1% | 1/6W      | RN1/6FS    |
| R7                      | 42-80-2221           | FXD M FILM   | 2.2K          | OHM 1% | 1/6W      | RN1/6FS    |
| R9                      | 40-16-1331           | FXD C FILM   | 330           | OHM 5% | 1/6W      | RD1/6FS    |
| R10                     | 40-16-2331           | FXD C FILM   | 3.3K          | OHM 5% | 1/6W      | RD1/6FS    |
| R11                     | 40-16-2331           | FXD C FILM   | 3.3K          | OHM 5% | 1/6W      | RD1/6FS    |
| R12                     | 40-16-2561           | FXD C FILM   | 5.6K          | OHM 5% | 1/6W      | RD1/6FS    |
| R13                     | 42-80-2331           | FXD M FILM   | 3.3K          | OHM 1% | 1/6W      | RN1/6FS    |
| R14                     | 42-80-2471           | FXD M FILM   | 4.7K          | OHM 1% | 1/6W      | RN1/6FS    |
| R15                     | 40-16-2221           | FXD C FILM   | 2.2K          | OHM 5% | 1/6W      | RD1/6FS    |
| R16                     | 40-16-1681           | FXD C FILM   | 680           | OHM 5% | 1/6W      | RD1/6FS    |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                   | 97-11-0060       |            |
|-------------------------|----------------------|-------------------------------|------------------|------------|
| R17                     | 44-07-0070           | FXD M GLAZE R-NET             | 3.3K OHM X8      |            |
| R18                     | 44-07-0150           | FXD M GLAZE R-NET             | 4.7K OHM X4      |            |
| R24                     | 40-16-3221           | FXD C FILM                    | 22K OHM 5% 1/6W  | RD1/6FS    |
| R25                     | 40-16-2101           | FXD C FILM                    | 1K OHM 5% 1/6W   | RD1/6FS    |
| R26                     | 40-16-1821           | FXD C FILM                    | 820 OHM 5% 1/6W  | RD1/6FS    |
| R27                     | 40-16-2101           | FXD C FILM                    | 1K OHM 5% 1/6W   | RD1/6FS    |
| R28                     | 40-16-2181           | FXD C FILM                    | 1.8K OHM 5% 1/6W | RD1/6FS    |
| R29                     | 40-16-2181           | FXD C FILM                    | 1.8K OHM 5% 1/6W | RD1/6FS    |
| R30                     | 40-16-1101           | FXD C FILM                    | 100 OHM 5% 1/6W  | RD1/6FS    |
| R31                     | 40-16-1391           | FXD C FILM                    | 390 OHM 5% 1/6W  | RD1/6FS    |
| R32                     | 42-80-2151           | FXD M FILM                    | 1.5K OHM 1% 1/6W | RN1/6FS    |
| R33                     | 42-80-2331           | FXD M FILM                    | 3.3K OHM 1% 1/6W | RN1/6FS    |
| R34                     | 40-16-2471           | FXD C FILM                    | 4.7K OHM 5% 1/6W | RD1/6FS    |
| R35                     | 40-16-5101           | FXD C FILM                    | 1M OHM 5% 1/6W   | RD1/6FS    |
| R36                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R37                     | 40-16-3561           | FXD C FILM                    | 56K OHM 5% 1/6W  | RD1/6FS    |
| R38                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R39                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R40                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R41                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R42                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R43                     | 42-80-2561           | FXD M FILM                    | 5.6K OHM 1% 1/6W | RN1/6FS    |
| R44                     | 40-16-2271           | FXD C FILM                    | 2.7K OHM 5% 1/6W | RD1/6FS    |
| R45                     | 42-80-3101           | FXD M FILM                    | 10K OHM 1% 1/6W  | RN1/6FS    |
| R46                     | 42-80-2391           | FXD M FILM                    | 3.9K OHM 1% 1/6W | RN1/6FS    |
| R47                     | 42-80-1271           | FXD M FILM                    | 270 OHM 1% 1/6W  | RN1/6FS    |
| R48                     | 42-80-1681           | FXD M FILM                    | 680 OHM 1% 1/6W  | RN1/6FS    |
| R49                     | 42-80-1471           | FXD M FILM                    | 470 OHM 1% 1/6W  | RN1/6FS    |
| R50                     | 42-80-2471           | FXD M FILM                    | 4.7K OHM 1% 1/6W | RN1/6FS    |
| R51                     | 40-16-1221           | FXD C FILM                    | 220 OHM 5% 1/6W  | RD1/6FS    |
| R52                     | 42-80-3101           | FXD M FILM                    | 10K OHM 1% 1/6W  | RN1/6FS    |
| R53                     | 42-80-2821           | FXD M FILM                    | 8.2K OHM 1% 1/6W | RN1/6FS    |
| R54                     | 42-80-1471           | FXD M FILM                    | 470 OHM 1% 1/6W  | RN1/6FS    |
| R55                     | 42-80-1681           | FXD M FILM                    | 680 OHM 1% 1/6W  | RN1/6FS    |
| R56                     | 42-80-1271           | FXD M FILM                    | 270 OHM 1% 1/6W  | RN1/6FS    |
| R57                     | 40-16-3101           | FXD C FILM                    | 10K OHM 5% 1/6W  | RD1/6FS    |
| R58                     | 42-80-1101           | FXD M FILM                    | 100 OHM 1% 1/6W  | RN1/6FS    |
| R59                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R60                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R61                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| R63                     | 40-16-2331           | FXD C FILM                    | 3.3K OHM 5% 1/6W | RD1/6FS    |
| R64                     | 40-16-1101           | FXD C FILM                    | 100 OHM 5% 1/6W  | RD1/6FS    |
| R65                     | 40-16-2221           | FXD C FILM                    | 2.2K OHM 5% 1/6W | RD1/6FS    |
| RV1                     | 48-37-3100           | VAR M FILM                    | 10K OHM B        | VM5CKPV    |
| U01                     | 35-70-0746           | DUAL D F-F EDGE TRIGGER       | TOSHIBA          | TC74HC74P  |
| U05                     | 35-70-0046           | HEX INVERTERS                 | TOSHIBA          | TC74HC04P  |
| U06                     | 35-70-1396           | 2LINE TO 4LINE DECORDER       | TOSHIBA          | TC74HC139P |
| U07                     | 35-70-0086           | QUAD 2-INPUT POSI-AND         | TOSHIBA          | TC74HC08P  |
| U11                     | 35-70-0746           | DUAL D F-F EDGE TRIGGER       | TOSHIBA          | TC74HC74P  |
| U12                     | 36-90-0110           | Z80A-CPU 4MHZ                 | SHARP            | LH0080A    |
| U13                     | 35-05-0010           | EPROM 32K X 8BIT 250NS (CMOS) |                  | 27C256     |
| U15                     | 35-56-0111           | S-RAM 2KX8BIT CMOS            | HITACHI          | HM6116P-3  |

| REFERENCE<br>SIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                    | 97-11-0060            |
|-----------------------|----------------------|--------------------------------|-----------------------|
| 16                    | 35-53-0304           | 8-INPUT POSI-NAND GATE         | TOSIHBA TC74HC30P     |
| 18                    | 35-70-1646           | 8BIT PARALOAD SHIFTREGISTER    | HITACHI HD74HC164P    |
| 21                    | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA TC74HC157P    |
| 26                    | 34-44-0010           | RESET IC                       | TEXAS INS. TL7705CP   |
| 28                    | 35-70-0006           | QUAD 2-INPUT POSI-NAND         | TOSHIBA TC74HC00P     |
| 33                    | 35-56-0080           | S-RAM 2KW X 8BIT 200NS         | HITACHI HM6117LP-4    |
| 34                    | 35-53-2454           | OCTAL BUS TRANSCEIVER          | TOSHIBA TC74HC245P    |
| 36                    | 35-53-5414           | OCTAL BUFFER                   | TEXAS INS. SN7HCS541N |
| 37                    | 35-53-1744           | HEX D-TYPE FLIP FLOP           | TOSHIBA TC74HC174P    |
| 38                    | 35-70-2991           | 8 BIT SHIFT RESISTER           | TEXAS INS. SN74LS299N |
| 41                    | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA TC74HC157P    |
| 42                    | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA TC74HC157P    |
| 43                    | 35-70-1576           | QUAD 2-TO-1 DATA SELECTORS     | TOSHIBA TC74HC157P    |
| 45                    | 35-70-1386           | 3LINE TO 8LINE DECORDER        | HITACHI HD74HC138P    |
| 46                    | 35-70-1396           | 2LINE TO 4LINE DECORDER        | TOSHIBA TC74HC139P    |
| 47                    | 35-70-0326           | QUAD 2-INPUT POSI-OR           | TOSHIBA TC74HC32P     |
| 51                    | 35-53-1074           | DUAL J-K F-F WITH P/C          | TOSHIBA TC74HC107P    |
| 52                    | 35-56-0665           | QUAD BILATERAL SWITCH          | TOSHIBA TC74HC4066    |
| 53                    | 35-70-0111           | TRI 3-INPUT POSI-AND           | HITACHI HD74LS11P     |
| 54                    | 35-53-3904           | DUAL DECADE COUNTERS           | TOSHIBA TC74HC390P    |
| 55                    | 35-53-3904           | DUAL DECADE COUNTERS           | TOSHIBA TC74HC390P    |
| 56                    | 35-53-2574           | QUAD DATA SELEC./MULTI.        | TOSHIBA TC74HC257P    |
| 57                    | 35-70-0326           | QUAD 2-INPUT POSI-OR           | TOSHIBA TC74HC32P     |
| 61                    | 35-70-0046           | HEX INVERTERS                  | TOSHIBA TC74HC04P     |
| 62                    | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA TC74HC4094    |
| 63                    | 35-53-1074           | DUAL J-K F-F WITH P/C          | TOSHIBA TC74HC107P    |
| 64                    | 35-56-0665           | QUAD BILATERAL SWITCH          | TOSHIBA TC74HC4066    |
| 65                    | 35-70-0746           | DUAL D F-F EDGE TRIGGER        | TOSHIBA TC74HC74P     |
| 66                    | 35-57-0530           | 3 DIG BCD COUNTER              | MOTOROLA MC14553B     |
| 67                    | 35-53-2574           | QUAD DATA SELEC./MULTI.        | TOSHIBA TC74HC257P    |
| 71                    | 35-73-5900           | 8 BIT BINARY COUNTER/RESISTERS | TEXAS INS. SN74LS590N |
| 72                    | 35-42-0010           | P ROM 32 X 8BIT 25NS           | TEXAS INS. TBP18S030N |
| 73                    | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA TC74HC574P    |
| 74                    | 35-70-0086           | QUAD 2-INPUT POSI-AND          | TOSHIBA TC74HC08P     |
| 75                    | 35-53-3934           | DUAL 4 BIT BINALY COUNTER      | TOSHIBA TC74HC393P    |
| 76                    | 35-73-5900           | 8 BIT BINARY COUNTER/RESISTERS | TEXAS INS. SN74LS590N |
| 77                    | 35-53-5414           | OCTAL BUFFER                   | TEXAS INS. SN7HCS541N |
| 78                    | 35-53-1254           | QUAD BUS BUFFER GATES (3-ST)   | TOSHIBA TC74HC125P    |
| 81                    | 35-70-0746           | DUAL D F-F EDGE TRIGGER        | TOSHIBA TC74HC74P     |
| 82                    | 35-70-0326           | QUAD 2-INPUT POSI-OR           | TOSHIBA TC74HC32P     |
| 83                    | 35-53-0144           | HEX SHMITT-TRIG INVERTER       | TOSHIBA TC74HC14P     |
| 84                    | 35-70-0046           | HEX INVERTERS                  | TOSHIBA TC74HC04P     |
| 85                    | 35-56-0111           | S-RAM 2KX8BIT CMOS             | HITACHI HM6116P-3     |
| 86                    | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA TC74HC574P    |
| 87                    | 35-53-2454           | OCTAL BUS TRANSCEIVER          | TOSHIBA TC74HC245P    |
| 91                    | 35-53-3904           | DUAL DECADE COUNTERS           | TOSHIBA TC74HC390P    |
| 92                    | 34-69-0080           | TRIPLE 8-CHANNEL MULTIPLEXER   | TOSHIBA TC4051BP      |
| 93                    | 34-69-0030           | TRIPLE 2-CHANNEL MULTIPLEXER   | TOSHIBA TC4053BP      |
| 94                    | 35-53-3934           | DUAL 4 BIT BINALY COUNTER      | TOSHIBA TC74HC393P    |
| 101                   | 35-53-3904           | DUAL DECADE COUNTERS           | TOSHIBA TC74HC390P    |
| 102                   | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER     | TOSHIBA TC74HC4094    |
| 103                   | 35-70-0086           | QUAD 2-INPUT POSI-AND          | TOSHIBA TC74HC08P     |
| 104                   | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F     | TOSHIBA TC74HC574P    |
| 105                   | 35-05-0010           | EPROM 32K X 8BIT 250NS (CMOS)  | 27C256                |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                | 97-11-0060 |            |            |
|-------------------------|----------------------|----------------------------|------------|------------|------------|
| U106                    | 35-70-0086           | QUAD 2-INPUT POSI-AND      |            | TOSHIBA    | TC74HC08P  |
| U107                    | 35-56-0945           | 8 BIT SHIFT/STORE RESISTER |            | TOSHIBA    | TC74HC4094 |
| U112                    | 35-70-0046           | HEX INVERTERS              |            | TOSHIBA    | TC74HC04P  |
| U113                    | 35-70-0746           | DUAL D F-F EDGE TRIGGER    |            | TOSHIBA    | TC74HC74P  |
| U114                    | 34-22-0010           | D/A CONVERTER 8BIT 85NS    |            | HITACHI    | HA17008RP  |
| U115                    | 35-70-1736           | 4 BIT D TYPE RESISTERS     |            | TOSHIBA    | TC74HC173P |
| U116                    | 34-22-0010           | D/A CONVERTER 8BIT 85NS    |            | HITACHI    | HA17008RP  |
| U117                    | 34-00-0340           | FET INPUT DUAL OP AMP      |            | TEXAS INS. | TL082CP    |
| U118                    | 34-69-0070           | ANALOG MULTIPLEXER         |            | HITACHI    | HD14052B   |
| X1                      | 93-00-0180           | QUARTS HC-49/U             | 8MHZ       | KIKUSUI    | S8409201   |
| X2                      | 93-00-0230           | QUARTS HC-49/U             | 10MHZ (AT) | KIKUSUI    | S8510031   |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION        | 97-11-0070        |            |
|-------------------------|----------------------|--------------------|-------------------|------------|
| A10 ASSEMBLY            |                      |                    |                   |            |
| C1                      | 52-01-3365           | FXD CER 1500PF     | 10% 50V TYPE2     |            |
| C2                      | 52-01-3365           | FXD CER 1500PF     | 10% 50V TYPE2     |            |
| C3                      | 52-01-3365           | FXD CER 1500PF     | 10% 50V TYPE2     |            |
| C4                      | 52-01-3365           | FXD CER 1500PF     | 10% 50V TYPE2     |            |
| C5                      | 52-01-3365           | FXD CER 1500PF     | 10% 50V TYPE2     |            |
| C6                      | 52-01-3365           | FXD CER 1500PF     | 10% 50V TYPE2     |            |
| C7                      | 50-67-0030           | FXD PLSTC FILM     | 0.01MF 10% 100WV  |            |
| C8                      | 55-37-2100           | FXD TANT ELECT     | 10UF 35V          |            |
| C9                      | 52-05-2468           | FXD CER 0.01UF     | +80-20% 50V TYPE2 |            |
| C10                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C11                     | 52-05-2468           | FXD CER 0.01UF     | +80-20% 50V TYPE2 |            |
| C12                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C13                     | 52-06-2225           | FXD CER 100PF      | 10% 50V TYPE1     |            |
| C15                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C16                     | 52-01-2305           | FXD CER 470PF      | 10% 50V TYPE2     |            |
| C17                     | 52-06-2184           | FXD CER 47PF       | 10% 50V TYPE1     |            |
| C18                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C19                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C20                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C21                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C22                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C23                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C24                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C25                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C26                     | 54-30-1960           | FXD ELECT 47MF     | 25WV              |            |
| C27                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C28                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C29                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C30                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C31                     | 54-30-1960           | FXD ELECT 47MF     | 25WV              |            |
| C32                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C33                     | 54-40-1200           | FXD ELECT 10MF     | 50WV              |            |
| C34                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C35                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C36                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C37                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C38                     | 52-37-1000           | FXD CER 0.047UF    | 20% 25V TYPE1     |            |
| C39                     | 54-20-1220           | FXD ELECT 470MF    | 16WV              | KME16VB470 |
| CR1                     | 32-30-1200           | DIODE VR=60V IO=1A | HITACHI           | 1SS120     |
| CR2                     | 32-30-1200           | DIODE VR=60V IO=1A | HITACHI           | 1SS120     |
| CR3                     | 32-30-1200           | DIODE VR=60V IO=1A | HITACHI           | 1SS120     |
| R1                      | 40-16-4101           | FXD C FILM 100K    | OHM 5% 1/6W       | RD1/6FS    |
| R2                      | 40-16-4101           | FXD C FILM 100K    | OHM 5% 1/6W       | RD1/6FS    |
| R3                      | 40-16-4101           | FXD C FILM 100K    | OHM 5% 1/6W       | RD1/6FS    |
| R4                      | 40-16-4101           | FXD C FILM 100K    | OHM 5% 1/6W       | RD1/6FS    |
| R5                      | 40-16-4101           | FXD C FILM 100K    | OHM 5% 1/6W       | RD1/6FS    |
| R6                      | 40-16-4101           | FXD C FILM 100K    | OHM 5% 1/6W       | RD1/6FS    |
| R8                      | 40-16-2271           | FXD C FILM 2.7K    | OHM 5% 1/6W       | RD1/6FS    |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                   | 97-11-0070  |            |
|-------------------------|----------------------|-------------------------------|-------------|------------|
| R9                      | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R10                     | 40-16-4101           | FXD C FILM 100K               | OHM 5% 1/6W | RD1/6FS    |
| R11                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R12                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R13                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R14                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R15                     | 42-80-2101           | FXD M FILM 1K                 | OHM 1% 1/6W | RN1/6FS    |
| R16                     | 42-80-2101           | FXD M FILM 1K                 | OHM 1% 1/6W | RN1/6FS    |
| R17                     | 42-80-2101           | FXD M FILM 1K                 | OHM 1% 1/6W | RN1/6FS    |
| R18                     | 42-80-2391           | FXD M FILM 3.9K               | OHM 1% 1/6W | RN1/6FS    |
| R19                     | 42-80-2391           | FXD M FILM 3.9K               | OHM 1% 1/6W | RN1/6FS    |
| R21                     | 40-16-1101           | FXD C FILM 100                | OHM 5% 1/6W | RD1/6FS    |
| R22                     | 40-16-0221           | FXD C FILM 22                 | OHM 5% 1/6W | RD1/6FS    |
| R23                     | 40-16-1101           | FXD C FILM 100                | OHM 5% 1/6W | RD1/6FS    |
| R24                     | 40-16-1101           | FXD C FILM 100                | OHM 5% 1/6W | RD1/6FS    |
| R25                     | 40-16-2471           | FXD C FILM 4.7K               | OHM 5% 1/6W | RD1/6FS    |
| R26                     | 40-16-4101           | FXD C FILM 100K               | OHM 5% 1/6W | RD1/6FS    |
| R27                     | 40-16-2471           | FXD C FILM 4.7K               | OHM 5% 1/6W | RD1/6FS    |
| R28                     | 40-16-4101           | FXD C FILM 100K               | OHM 5% 1/6W | RD1/6FS    |
| R29                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R30                     | 40-16-3101           | FXD C FILM 10K                | OHM 5% 1/6W | RD1/6FS    |
| R32                     | 40-16-2561           | FXD C FILM 5.6K               | OHM 5% 1/6W | RD1/6FS    |
| R33                     | 40-16-2221           | FXD C FILM 2.2K               | OHM 5% 1/6W | RD1/6FS    |
| R35                     | 40-16-2561           | FXD C FILM 5.6K               | OHM 5% 1/6W | RD1/6FS    |
| R36                     | 40-16-2221           | FXD C FILM 2.2K               | OHM 5% 1/6W | RD1/6FS    |
| R37                     | 40-16-2471           | FXD C FILM 4.7K               | OHM 5% 1/6W | RD1/6FS    |
| R38                     | 40-16-2471           | FXD C FILM 4.7K               | OHM 5% 1/6W | RD1/6FS    |
| R39                     | 40-16-0101           | FXD C FILM 10                 | OHM 5% 1/6W | RD1/6FS    |
| R40                     | 40-16-0101           | FXD C FILM 10                 | OHM 5% 1/6W | RD1/6FS    |
| R41                     | 40-27-0102           | FXD C FILM 10                 | OHM 5% 1/4W | NAS1/4S    |
| R43                     | 42-80-2101           | FXD M FILM 1K                 | OHM 1% 1/6W | RN1/6FS    |
| R44                     | 42-80-1151           | FXD M FILM 150                | OHM 1% 1/6W | RN1/6FS    |
| R45                     | 40-16-3471           | FXD C FILM 47K                | OHM 5% 1/6W | RD1/6FS    |
| U1                      | 35-57-0840           | HEX SCHMITT TRIGGER           | TOSHIBA     | TC4584BP   |
| U2                      | 35-70-0086           | QUAD 2-INPUT POSI-AND         | TOSHIBA     | TC74HC08P  |
| U3                      | 35-70-1936           | 4 BIT UP/DOWN BINARY COUNTERS | TOSHIBA     | TC74HC193P |
| U4                      | 35-70-1936           | 4 BIT UP/DOWN BINARY COUNTERS | TOSHIBA     | TC74HC193P |
| U5                      | 35-70-1936           | 4 BIT UP/DOWN BINARY COUNTERS | TOSHIBA     | TC74HC193P |
| U6                      | 35-69-0010           | DUAL MONOSTABLE MULTI         | MOTOROLA    | MC14538BCP |
| U7                      | 35-53-5414           | OCTAL BUFFER                  | TEXAS INS.  | SN7HCS541N |
| U8                      | 35-53-5414           | OCTAL BUFFER                  | TEXAS INS.  | SN7HCS541N |
| U9                      | 35-70-1386           | 3LINE TO 8LINE DECORDER       | HITACHI     | HD74HC138P |
| U10                     | 35-70-0326           | QUAD 2-INPUT POSI-OR          | TOSHIBA     | TC74HC32P  |
| U11                     | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F    | TOSHIBA     | TC74HC574P |
| U12                     | 35-70-5746           | OCTAL D TYPE EDGE TRIG F/F    | TOSHIBA     | TC74HC574P |
| U13                     | 36-20-0100           | D/A CONVERTER 12BIT           | HITACHI     | HA17012PB  |
| U14                     | 34-00-0390           | FET INPUT DUAL OP AMP         | NEC         | UPC812C    |
| U15                     | 34-20-0130           | DUAL COMPARATORS              | HITACHI     | HA17903PS  |
| U16                     | 35-53-3654           | HEX BUS DRIVERS               | TOSHIBA     | TC74HC365P |
| U17                     | 35-02-0020           | PROG.KEY & DISP CONTROL       | NEC         | UPD8279C-2 |
| U18                     | 35-53-0304           | 8-INPUT POSI-NAND GATE        | TOSHIBA     | TC74HC30P  |
| U19                     | 35-70-0046           | HEX INVERTERS                 | TOSHIBA     | TC74HC04P  |
| U20                     | 34-00-0340           | FET INPUT DUAL OP AMP         | TEXAS INS.  | TL082CP    |

REFERENCE KIKUSUI  
 DESIGNATOR PARTS NO.

DESCRIPTION 97-11-0081

A11 ASSEMBLY

|      |            |                 |               |            |
|------|------------|-----------------|---------------|------------|
| C1   | 54-40-1200 | FXD ELECT 10MF  | 50WV          |            |
| C2   | 54-20-1210 | FXD ELECT 220MF | 16WV          | KME16VB220 |
| C3   | 54-40-1200 | FXD ELECT 10MF  | 50WV          |            |
| C4   | 54-20-1210 | FXD ELECT 220MF | 16WV          | KME16VB220 |
| C5   | 54-40-1200 | FXD ELECT 10MF  | 50WV          |            |
| C6   | 54-40-1200 | FXD ELECT 10MF  | 50WV          |            |
| C7   | 52-37-1000 | FXD CER 0.047UF | 20% 25V TYPE1 |            |
| C8   | 54-40-1200 | FXD ELECT 10MF  | 50WV          |            |
| CR1  | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR3  | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR4  | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR5  | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR7  | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR8  | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR11 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR12 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR13 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR14 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR15 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR16 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR17 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR18 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR21 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR22 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR23 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR24 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR25 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR26 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR27 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR28 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR31 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR32 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR33 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR34 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR35 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR36 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR37 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR38 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR41 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR42 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR43 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR44 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR45 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR46 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR47 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR48 | 37-00-0430 | LAMP LED GREEN  | TOSHIBA       | TLUG163    |
| CR51 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR52 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |
| CR53 | 37-00-0440 | LAMP LED RED    | TOSHIBA       | TLUY163    |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION       | 97-11-0081  |           |  |
|-------------------------|----------------------|-------------------|-------------|-----------|--|
| CR54                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR55                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR56                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR57                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR58                    | 37-00-0430           | LAMP LED GREEN    | TOSHIBA     | TLUG163   |  |
| CR61                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR62                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR63                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR64                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR65                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR66                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR67                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR81                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR82                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR83                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR84                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR85                    | 37-00-0430           | LAMP LED GREEN    | TOSHIBA     | TLUG163   |  |
| CR86                    | 37-00-0430           | LAMP LED GREEN    | TOSHIBA     | TLUG163   |  |
| CR87                    | 37-00-0430           | LAMP LED GREEN    | TOSHIBA     | TLUG163   |  |
| CR88                    | 37-00-0430           | LAMP LED GREEN    | TOSHIBA     | TLUG163   |  |
| CR93                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR94                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR95                    | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR101                   | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR102                   | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR103                   | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR104                   | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR105                   | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR106                   | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR121                   | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| CR122                   | 37-00-0440           | LAMP LED RED      | TOSHIBA     | TLUY163   |  |
| L1                      | 67-10-0890           | INDUCTOR 100MH    | 10%         |           |  |
| L2                      | 67-10-0890           | INDUCTOR 100MH    | 10%         |           |  |
| Q1                      | 30-11-0151           | TR SI PNP         | TOSHIBA     | 2SA1015-Y |  |
| R1                      | 40-16-0221           | FXD C FILM 22     | OHM 5% 1/6W | RD1/6FS   |  |
| R2                      | 40-16-0221           | FXD C FILM 22     | OHM 5% 1/6W | RD1/6FS   |  |
| R3                      | 40-16-0221           | FXD C FILM 22     | OHM 5% 1/6W | RD1/6FS   |  |
| R4                      | 40-16-0221           | FXD C FILM 22     | OHM 5% 1/6W | RD1/6FS   |  |
| R5                      | 40-16-0221           | FXD C FILM 22     | OHM 5% 1/6W | RD1/6FS   |  |
| R6                      | 40-16-0221           | FXD C FILM 22     | OHM 5% 1/6W | RD1/6FS   |  |
| R7                      | 40-16-0221           | FXD C FILM 22     | OHM 5% 1/6W | RD1/6FS   |  |
| R8                      | 40-16-0221           | FXD C FILM 22     | OHM 5% 1/6W | RD1/6FS   |  |
| R9                      | 40-16-2471           | FXD C FILM 4.7K   | OHM 5% 1/6W | RD1/6FS   |  |
| R10                     | 40-16-2101           | FXD C FILM 1K     | OHM 5% 1/6W | RD1/6FS   |  |
| R12                     | 40-16-1331           | FXD C FILM 330    | OHM 5% 1/6W | RD1/6FS   |  |
| R13                     | 44-07-0020           | FXD M GLAZE R-NET | 10K OHM X4  |           |  |
| R15                     | 40-16-3101           | FXD C FILM 10K    | OHM 5% 1/6W | RD1/6FS   |  |
| R16                     | 40-16-3101           | FXD C FILM 10K    | OHM 5% 1/6W | RD1/6FS   |  |
| RV1                     | 45-01-0820           | VAR C COMP        | KIKUSUI     | V12L5DM1S |  |
| RV2                     | 45-01-0820           | VAR C COMP        | KIKUSUI     | V12L5DM1S |  |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION             | 97-11-0081    |         |            |
|-------------------------|----------------------|-------------------------|---------------|---------|------------|
| RV3                     | 45-01-0830           | VAR C COMP              |               | KIKUSUI | V12L5DM1S  |
| RV4                     | 45-02-0280           | VAR C COMP              | 20K/20K OHM B | KIKUSUI | V12LG3N    |
| RV5                     | 45-01-0810           | VAR C COMP              | 20K/20K OHM B | KIKUSUI | V12LG3S    |
| RV6                     | 45-02-0280           | VAR C COMP              | 20K/20K OHM B | KIKUSUI | V12LG3N    |
| RV7                     | 45-02-0280           | VAR C COMP              | 20K/20K OHM B | KIKUSUI | V12LG3N    |
| RV8                     | 45-01-0810           | VAR C COMP              | 20K/20K OHM B | KIKUSUI | V12LG3S    |
| RV9                     | 45-02-0280           | VAR C COMP              | 20K/20K OHM B | KIKUSUI | V12LG3N    |
| RV10                    | 45-01-0810           | VAR C COMP              | 20K/20K OHM B | KIKUSUI | V12LG3S    |
| S1                      | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S2                      | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S3                      | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S4                      | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S5                      | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S6                      | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S11                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S12                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S13                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S14                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S15                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S16                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S21                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S22                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S23                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S24                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S25                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S26                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S27                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S28                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S31                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S32                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S33                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S34                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S35                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S36                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S37                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S41                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S43                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S44                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S45                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S48                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S49                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S51                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S52                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S55                     | 81-01-0870           | PUSH SWITCH             |               |         | TM1-01     |
| S107                    | 81-01-0860           | PUSH SWITCH             |               | ALPS    | SSCTP1     |
| U1                      | 35-91-0010           | 8-LINE DRIVER           |               | TOSHIBA | TD62381P   |
| U2                      | 35-70-1386           | 3LINE TO 8LINE DECORDER |               | HITACHI | HD74HC138P |
| U3                      | 35-91-0020           | 8-LINE DRIVER           |               | TOSHIBA | TD62785P   |
| U4                      | 35-70-1386           | 3LINE TO 8LINE DECORDER |               | HITACHI | HD74HC138P |
| U5                      | 35-91-0020           | 8-LINE DRIVER           |               | TOSHIBA | TD62785P   |
| U6                      | 35-62-0010           | 8-CH ANALOG MULTI-PLX   |               | HITACHI | HD14051BP  |
| U7                      | 35-62-0010           | 8-CH ANALOG MULTI-PLX   |               | HITACHI | HD14051BP  |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION             | 97-11-0081 |            |  |
|-------------------------|----------------------|-------------------------|------------|------------|--|
| U8                      | 35-70-1386           | 3LINE TO 8LINE DECORDER | HITACHI    | HD74HC138P |  |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION             | 97-11-0090                    |
|-------------------------|----------------------|-------------------------|-------------------------------|
| A12 ASSEMBLY            |                      |                         |                               |
| C1                      | 52-77-1010           | FXD CER 1000PF          | 250VAC FOR UL & CSA           |
| C2                      | 52-77-1010           | FXD CER 1000PF          | 250VAC FOR UL & CSA           |
| C3                      | 50-77-3510           | FXD PLSTC FILM 0.1MF    | 20% 250AC                     |
| C4                      | 54-80-1110           | FXD ELECT 120MF         | 400WV KME400VNSN              |
| C5                      | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C6                      | 54-30-1960           | FXD ELECT 47MF          | 25WV                          |
| C7                      | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C8                      | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C9                      | 52-01-4030           | FXD CER 220PF           | 10% 1KWV MATSUSITA ECKD3A221K |
| C10                     | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C11                     | 50-67-0000           | FXD PLSTC FILM 0.001MF  | 10% 100WV                     |
| C12                     | 52-01-3345           | FXD CER 1000PF          | 10% 500V TYPE2                |
| C13                     | 50-67-0060           | FXD PLSTC FILM 0.1MF    | 10% 100WV                     |
| C14                     | 54-30-1960           | FXD ELECT 47MF          | 25WV                          |
| C16                     | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C17                     | 52-01-4030           | FXD CER 220PF           | 10% 1KWV MATSUSITA ECKD3A221K |
| C18                     | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C19                     | 50-67-0000           | FXD PLSTC FILM 0.001MF  | 10% 100WV                     |
| C20                     | 52-01-3345           | FXD CER 1000PF          | 10% 500V TYPE2                |
| C21                     | 50-67-0060           | FXD PLSTC FILM 0.1MF    | 10% 100WV                     |
| C22                     | 54-30-1960           | FXD ELECT 47MF          | 25WV                          |
| C32                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C33                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C34                     | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C35                     | 50-67-0000           | FXD PLSTC FILM 0.001MF  | 10% 100WV                     |
| C38                     | 54-30-2800           | FXD ELECT 680MF         | 35WV SXE35VB680               |
| C39                     | 54-30-2800           | FXD ELECT 680MF         | 35WV SXE35VB680               |
| C41                     | 54-30-2800           | FXD ELECT 680MF         | 35WV SXE35VB680               |
| C42                     | 54-30-2800           | FXD ELECT 680MF         | 35WV SXE35VB680               |
| C43                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C44                     | 52-03-3469           | FXD CER 0.01UF          | +100-0% 500V TYPE2            |
| C45                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C46                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C47                     | 54-60-2070           | FXD ELECT 22MF          | 200WV KME200VB22              |
| C48                     | 54-30-2790           | FXD ELECT 82MF          | 35WV SXE35VB82                |
| C49                     | 54-30-2780           | FXD ELECT 330MF         | 35WV SXE35VB330               |
| C50                     | 54-30-2780           | FXD ELECT 330MF         | 35WV SXE35VB330               |
| C51                     | 54-20-1190           | FXD ELECT 680MF         | 16WV SXE16VB680               |
| C52                     | 50-67-0030           | FXD PLSTC FILM 0.01MF   | 10% 100WV                     |
| C53                     | 54-10-2750           | FXD ELECT 3900MF        | 10WV SXE10VB                  |
| C54                     | 54-10-2750           | FXD ELECT 3900MF        | 10WV SXE10VB                  |
| C58                     | 50-67-0010           | FXD PLSTC FILM 0.0022MF | 10% 100WV                     |
| C59                     | 54-10-2740           | FXD ELECT 820MF         | 10WV SXE10VB820               |
| C61                     | 55-37-2030           | FXD TANT ELECT 0.47MF   | 35V                           |
| C62                     | 54-10-2740           | FXD ELECT 820MF         | 10WV SXE10VB820               |
| C63                     | 52-77-1010           | FXD CER 1000PF          | 250VAC FOR UL & CSA           |
| C104                    | 54-80-1110           | FXD ELECT 120MF         | 400WV KME400VNSN              |
| C114                    | 54-30-2790           | FXD ELECT 82MF          | 35WV SXE35VB82                |
| C161                    | 54-30-1960           | FXD ELECT 47MF          | 25WV                          |
| C173                    | 55-37-2050           | FXD TANT ELECT 1UF      | 35V                           |

| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION                | 97-11-0090 |            |
|-------------------------|----------------------|----------------------------|------------|------------|
| CR1                     | 32-90-2281           | DIODE BRIGE VRM=600V IO=4A | TOSHIBA    | 4J4B41     |
| CR2                     | 32-90-0523           | DIODE VR=600V IO=1A        | TOSHIBA    | S5277J     |
| CR3                     | 32-92-0130           | ZENER VZ=12.4-13.1V P=0.4W | NEC        | RD13JB1    |
| CR4                     | 32-90-3050           | DIODE VR=800V IO=1A        | HITACHI    | DFG1C8     |
| CR5                     | 32-90-0550           | DIODE VR=1KV IO=1A         | HITACHI    | V11M       |
| CR6                     | 32-90-0550           | DIODE VR=1KV IO=1A         | HITACHI    | V11M       |
| CR7                     | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR8                     | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR9                     | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR10                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR11                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR12                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR13                    | 32-91-1805           | ZENER VZ=5.48-5.76V P=0.4W | NEC        | RD5.6JSB2  |
| CR14                    | 32-92-0062           | ZENER VZ=5.8 - 6.6V P=0.4W | NEC        | RD6.2JB    |
| CR15                    | 32-90-3050           | DIODE VR=800V IO=1A        | HITACHI    | DFG1C8     |
| CR16                    | 32-90-0550           | DIODE VR=1KV IO=1A         | HITACHI    | V11M       |
| CR17                    | 32-90-0550           | DIODE VR=1KV IO=1A         | HITACHI    | V11M       |
| CR18                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR19                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR20                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR21                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR22                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR23                    | 32-11-8350           | DIODE VR=600V IO=1.0A      | TOSHIBA    | 1S1835     |
| CR24                    | 32-91-1805           | ZENER VZ=5.48-5.76V P=0.4W | NEC        | RD5.6JSB2  |
| CR30                    | 32-90-3050           | DIODE VR=800V IO=1A        | HITACHI    | DFG1C8     |
| CR31                    | 32-90-3050           | DIODE VR=800V IO=1A        | HITACHI    | DFG1C8     |
| CR32                    | 32-90-1843           | DIODE VR=200V IO=3A        | N.INTER    | 30DF2      |
| CR33                    | 32-90-1843           | DIODE VR=200V IO=3A        | N.INTER    | 30DF2      |
| CR34                    | 32-91-2300           | ZENER VZ=135 - 165V P=1W   | TOSHIBA    | 1Z150      |
| CR35                    | 32-92-0130           | ZENER VZ=12.4-13.1V P=0.4W | NEC        | RD13JB1    |
| CR36                    | 32-92-0130           | ZENER VZ=12.4-13.1V P=0.4W | NEC        | RD13JB1    |
| CR37                    | 32-30-1200           | DIODE VR=60V IO=1A         | HITACHI    | 1SS120     |
| CR38                    | 32-92-0056           | ZENER VZ=5.5 - 5.8V P=0.4W | NEC        | RD5.6JB2   |
| CR39                    | 32-90-2970           | DIODE VR= 40V IO=1.7A      | SANKEN     | RK14       |
| CR40                    | 32-90-2980           | DIODE VR= 40V IO=5A        | NEC        | 5CS04SM    |
| CR42                    | 32-91-1805           | ZENER VZ=5.48-5.76V P=0.4W | NEC        | RD5.6JSB2  |
| CR43                    | 32-92-0100           | ZENER VZ=10.1-10.6V P=0.4W | NEC        | RD10JB3    |
| L10                     | 67-10-0890           | INDUCTOR 100MH 10%         |            |            |
| L11                     | 67-10-0890           | INDUCTOR 100MH 10%         |            |            |
| L12                     | 67-10-0890           | INDUCTOR 100MH 10%         |            |            |
| L13                     | 67-10-0890           | INDUCTOR 100MH 10%         |            |            |
| L14                     | 67-10-0921           | INDUCTOR 470UH 10%         |            | LAL04NA    |
| L15                     | 67-15-0320           | INDUCTOR 15UH 4.5A         |            | HP10D150M  |
| L114                    | 67-10-0921           | INDUCTOR 470UH 10%         |            | LAL04NA    |
| PC1                     | 37-30-0111           | PHOT COUPLER               | TOSHIBA    | TLP521-1BL |
| PC2                     | 37-30-0111           | PHOT COUPLER               | TOSHIBA    | TLP521-1BL |
| PC3                     | 37-30-0111           | PHOT COUPLER               | TOSHIBA    | TLP521-1BL |
| PC4                     | 37-30-0111           | PHOT COUPLER               | TOSHIBA    | TLP521-1BL |
| Q1                      | 30-31-8151           | TR SI NPN (50V 0.15A 0.4W) | TOSHIBA    | 2SC1815-Y  |
| Q2                      | 30-11-0151           | TR SI PNP                  | TOSHIBA    | 2SA1015-Y  |
| Q3                      | 30-31-8461           | TR SI NPN                  | MATSUSITA  | 2SC1846-R  |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION |         | 97-11-0090       |             |                   |
|-------------------------|----------------------|-------------|---------|------------------|-------------|-------------------|
| Q4                      | 30-33-5590           | TR          | SI NPN  | (800V 3A 40W)    | TOSHIBA     | 2SC3559           |
| Q5                      | 30-33-4610           | TR          | SI NPN  | (1100V 8A 140W)  | SANYO       | 2SC3461           |
| Q6                      | 30-31-1731           | TR          | SI NPN  | (30V 3A 10W )    | TOSHIBA     | 2SC1173-Y         |
| Q7                      | 30-33-5590           | TR          | SI NPN  | (800V 3A 40W)    | TOSHIBA     | 2SC3559           |
| Q8                      | 30-33-4610           | TR          | SI NPN  | (1100V 8A 140W)  | SANYO       | 2SC3461           |
| Q9                      | 30-11-0151           | TR          | SI PNP  |                  | TOSHIBA     | 2SA1015-Y         |
| Q10                     | 30-31-1731           | TR          | SI NPN  | (30V 3A 10W )    | TOSHIBA     | 2SC1173-Y         |
| Q11                     | 30-21-0150           | TR          | SI PNP  | (60V 3A 25W)     | TOSHIBA     | 2SB1015-Y         |
| Q12                     | 30-41-4060           | TR          | SI NPN  | (60V 3A 25W)     | TOSHIBA     | 2SD1406-Y         |
| Q13                     | 30-41-4060           | TR          | SI NPN  | (60V 3A 25W)     | TOSHIBA     | 2SD1406-Y         |
| Q14                     | 30-31-8151           | TR          | SI NPN  | (50V 0.15A 0.4W) | TOSHIBA     | 2SC1815-Y         |
| Q15                     | 30-31-8151           | TR          | SI NPN  | (50V 0.15A 0.4W) | TOSHIBA     | 2SC1815-Y         |
| Q16                     | 30-11-0151           | TR          | SI PNP  |                  | TOSHIBA     | 2SA1015-Y         |
| R1                      | 40-16-5101           | FXD         | C FILM  | 1M               | OHM 5% 1/6W | RD1/6FS           |
| R2                      | 40-16-4471           | FXD         | C FILM  | 470K             | OHM 5% 1/6W | RD1/6FS           |
| R3                      | 40-16-2221           | FXD         | C FILM  | 2.2K             | OHM 5% 1/6W | RD1/6FS           |
| R4                      | 44-91-3684           | FXD         | M OXIDE | 68K              | OHM 5% 1W   | MATSUSITA ERG1ANJ |
| R5                      | 40-16-3151           | FXD         | C FILM  | 15K              | OHM 5% 1/6W | RD1/6FS           |
| R6                      | 40-16-2221           | FXD         | C FILM  | 2.2K             | OHM 5% 1/6W | RD1/6FS           |
| R7                      | 40-16-2561           | FXD         | C FILM  | 5.6K             | OHM 5% 1/6W | RD1/6FS           |
| R8                      | 40-16-2221           | FXD         | C FILM  | 2.2K             | OHM 5% 1/6W | RD1/6FS           |
| R9                      | 40-37-4471           | FXD         | C FILM  | 470K             | OHM 5% 1/2W | RD1/6FS           |
| R10                     | 44-57-0540           | FXD         | M OXIDE | 100K             | OHM 5% 2W   | MATSUSITA ERG2SJ  |
| R11                     | 44-92-1474           | FXD         | M OXIDE | 470              | OHM 5% 2W   | MATSUSITA ERG2ANJ |
| R12                     | 44-91-1334           | FXD         | M OXIDE | 330              | OHM 5% 1W   | MATSUSITA ERG1ANJ |
| R13                     | 40-27-1472           | FXD         | C FILM  | 470              | OHM 5% 1/4W |                   |
| R14                     | 42-83-0330           | FXD         | M FILM  | 33               | OHM 1% 1/4W |                   |
| R15                     | 44-91-9474           | FXD         | M OXIDE | 0.47             | OHM 5% 1W   | MATSUSITA ERX1ANJ |
| R16                     | 42-80-1681           | FXD         | M FILM  | 680              | OHM 1% 1/6W | RN1/6FS           |
| R17                     | 40-16-8561           | FXD         | C FILM  | 5.6              | OHM 5% 1/6W | RD1/6FS           |
| R18                     | 40-16-8561           | FXD         | C FILM  | 5.6              | OHM 5% 1/6W | RD1/6FS           |
| R19                     | 42-80-1331           | FXD         | M FILM  | 330              | OHM 1% 1/6W | RN1/6FS           |
| R20                     | 40-16-1101           | FXD         | C FILM  | 100              | OHM 5% 1/6W | RD1/6FS           |
| R21                     | 40-16-2101           | FXD         | C FILM  | 1K               | OHM 5% 1/6W | RD1/6FS           |
| R22                     | 40-16-1471           | FXD         | C FILM  | 470              | OHM 5% 1/6W | RD1/6FS           |
| R23                     | 40-37-4471           | FXD         | C FILM  | 470K             | OHM 5% 1/2W |                   |
| R24                     | 44-57-0540           | FXD         | M OXIDE | 100K             | OHM 5% 2W   | MATSUSITA ERG2SJ  |
| R25                     | 44-92-1474           | FXD         | M OXIDE | 470              | OHM 5% 2W   | MATSUSITA ERG2ANJ |
| R26                     | 44-91-1334           | FXD         | M OXIDE | 330              | OHM 5% 1W   | MATSUSITA ERG1ANJ |
| R27                     | 40-16-1471           | FXD         | C FILM  | 470              | OHM 5% 1/6W | RD1/6FS           |
| R28                     | 42-80-0221           | FXD         | M FILM  | 22               | OHM 1% 1/6W | RN1/6FS           |
| R29                     | 44-91-8124           | FXD         | M OXIDE | 1.2              | OHM 5% 1W   | MATSUSITA ERX1ANJ |
| R30                     | 42-80-1561           | FXD         | M FILM  | 560              | OHM 1% 1/6W | RN1/6FS           |
| R31                     | 40-16-8561           | FXD         | C FILM  | 5.6              | OHM 5% 1/6W | RD1/6FS           |
| R32                     | 42-80-1391           | FXD         | M FILM  | 390              | OHM 1% 1/6W | RN1/6FS           |
| R33                     | 40-16-1101           | FXD         | C FILM  | 100              | OHM 5% 1/6W | RD1/6FS           |
| R34                     | 40-16-2101           | FXD         | C FILM  | 1K               | OHM 5% 1/6W | RD1/6FS           |
| R35                     | 40-16-1471           | FXD         | C FILM  | 470              | OHM 5% 1/6W | RD1/6FS           |
| R42                     | 42-80-4151           | FXD         | M FILM  | 150K             | OHM 1% 1/6W | RN1/6FS           |
| R43                     | 42-80-2271           | FXD         | M FILM  | 2.7K             | OHM 1% 1/6W | RN1/6FS           |
| R44                     | 40-16-3101           | FXD         | C FILM  | 10K              | OHM 5% 1/6W | RD1/6FS           |
| R45                     | 40-16-1471           | FXD         | C FILM  | 470              | OHM 5% 1/6W | RD1/6FS           |
| R46                     | 40-16-2101           | FXD         | C FILM  | 1K               | OHM 5% 1/6W | RD1/6FS           |



| REFERENCE<br>DESIGNATOR | KIKUSUI<br>PARTS NO. | DESCRIPTION            | 97-11-0090  |                      |
|-------------------------|----------------------|------------------------|-------------|----------------------|
| R49                     | 44-91-9564           | FXD M OXIDE 0.56       | OHM 5% 1W   | MATSUSITA ERX1ANJ    |
| R50                     | 40-16-1101           | FXD C FILM 100         | OHM 5% 1/6W | RD1/6FS              |
| R51                     | 44-92-0334           | FXD M OXIDE 33         | OHM 5% 2W   | MATSUSITA ERG2ANJ    |
| R52                     | 44-91-9564           | FXD M OXIDE 0.56       | OHM 5% 1W   | MATSUSITA ERX1ANJ    |
| R53                     | 40-16-1101           | FXD C FILM 100         | OHM 5% 1/6W | RD1/6FS              |
| R54                     | 44-92-0151           | FXD M OXIDE 15         | OHM 5% 2W   | MATSUSITA ERG2ANJ    |
| R55                     | 40-16-2561           | FXD C FILM 5.6K        | OHM 5% 1/6W | RD1/6FS              |
| R56                     | 40-16-2561           | FXD C FILM 5.6K        | OHM 5% 1/6W | RD1/6FS              |
| R57                     | 40-16-2561           | FXD C FILM 5.6K        | OHM 5% 1/6W | RD1/6FS              |
| R58                     | 42-80-2201           | FXD M FILM 2K          | OHM 1% 1/6W | RN1/6FS              |
| R59                     | 42-80-2201           | FXD M FILM 2K          | OHM 1% 1/6W | RN1/6FS              |
| R60                     | 40-16-2101           | FXD C FILM 1K          | OHM 5% 1/6W | RD1/6FS              |
| R61                     | 40-16-2101           | FXD C FILM 1K          | OHM 5% 1/6W | RD1/6FS              |
| R65                     | 40-16-1331           | FXD C FILM 330         | OHM 5% 1/6W | RD1/6FS              |
| R66                     | 40-16-2101           | FXD C FILM 1K          | OHM 5% 1/6W | RD1/6FS              |
| R67                     | 44-91-9824           | FXD M OXIDE 0.82       | OHM 5% 1W   | MATSUSITA ERX1ANJ    |
| R68                     | 42-80-2101           | FXD M FILM 1K          | OHM 1% 1/6W | RN1/6FS              |
| R69                     | 42-80-2101           | FXD M FILM 1K          | OHM 1% 1/6W | RN1/6FS              |
| R70                     | 40-16-3221           | FXD C FILM 22K         | OHM 5% 1/6W | RD1/6FS              |
| R71                     | 40-27-0102           | FXD C FILM 10          | OHM 5% 1/4W | NAS1/4S              |
| R73                     | 42-80-2101           | FXD M FILM 1K          | OHM 1% 1/6W | RN1/6FS              |
| R74                     | 42-80-2101           | FXD M FILM 1K          | OHM 1% 1/6W | RN1/6FS              |
| R75                     | 40-16-3121           | FXD C FILM 12K         | OHM 5% 1/6W | RD1/6FS              |
| R76                     | 40-16-1471           | FXD C FILM 470         | OHM 5% 1/6W | RD1/6FS              |
| R77                     | 40-16-2101           | FXD C FILM 1K          | OHM 5% 1/6W | RD1/6FS              |
| R78                     | 40-16-2221           | FXD C FILM 2.2K        | OHM 5% 1/6W | RD1/6FS              |
| R79                     | 40-16-3221           | FXD C FILM 22K         | OHM 5% 1/6W | RD1/6FS              |
| R80                     | 40-16-0221           | FXD C FILM 22          | OHM 5% 1/6W | RD1/6FS              |
| R81                     | 40-16-2181           | FXD C FILM 1.8K        | OHM 5% 1/6W | RD1/6FS              |
| R82                     | 40-16-2221           | FXD C FILM 2.2K        | OHM 5% 1/6W | RD1/6FS              |
| R165                    | 40-16-1331           | FXD C FILM 330         | OHM 5% 1/6W | RD1/6FS              |
| R173                    | 40-16-1681           | FXD C FILM 680         | OHM 5% 1/6W | RD1/6FS              |
| RT1                     | 38-00-0120           | THERMISTOR             |             | 8D13                 |
| RV1                     | 48-31-2100           | VAR M GLAZE 1K         | OHM B PH    |                      |
| T1                      | 67-10-1760           | INDUCTOR 1MH           | 2.5A        | SC-02-10A2           |
| T2                      | 63-94-2130           | SWITCHING TRANS T-3W 2 |             | KIKUSUI S8513642     |
| T3                      | 63-94-2110           | SWITCHING TRANS T-1    |             | KIKUSUI S8508312     |
| TS1                     | 82-91-0350           | THERMOSTAT UL          |             | 5003F90B4            |
| U1                      | 34-90-0051           | REGULATOR              |             | TEXAS INS. TL431CLPB |
| U2                      | 34-00-0240           | DUAL OPE-AMP           |             | NEC UPC4558C         |
| U3                      | 34-90-0051           | REGULATOR              |             | TEXAS INS. TL431CLPB |
| U4                      | 34-90-0051           | REGULATOR              |             | TEXAS INS. TL431CLPB |
| VR1                     | 39-00-0410           | SURGE ABSORBER (430V)  |             | MATSUSITA ERZC07DK   |

|            |           |             |            |
|------------|-----------|-------------|------------|
| REFERENCE  | KIKUSUI   |             |            |
| DESIGNATOR | PARTS NO. | DESCRIPTION | 97-11-0100 |

A13 ASSEMBLY

|    |            |            |       |             |  |
|----|------------|------------|-------|-------------|--|
| C1 | 54-30-1970 | FXD ELECT  | 100MF | 25WV        |  |
| R1 | 40-37-0331 | FXD C FILM | 33    | OHM 5% 1/2W |  |

|              |            |
|--------------|------------|
| A20 ASSEMBLY | 97-11-0110 |
|--------------|------------|

|    |            |          |        |        |              |
|----|------------|----------|--------|--------|--------------|
| C1 | 52-77-1010 | FXD CER  | 1000PF | 250VAC | FOR UL & CSA |
| C2 | 52-77-1010 | FXD CER  | 1000PF | 250VAC | FOR UL & CSA |
| T1 | 67-10-1760 | INDUCTOR | 1MH    | 2.5A   | SC-02-10A2   |

|              |            |
|--------------|------------|
| A21 ASSEMBLY | 97-11-0200 |
|--------------|------------|

|    |            |            |        |             |         |
|----|------------|------------|--------|-------------|---------|
| L1 | 67-95-0010 | INDUCTOR   | L-2874 |             |         |
| L2 | 67-95-0010 | INDUCTOR   | L-2874 |             |         |
| L3 | 67-10-0870 | INDUCTOR   | 1UH    |             |         |
| L4 | 67-10-0870 | INDUCTOR   | 1UH    |             |         |
| R1 | 40-27-1332 | FXD C FILM | 330    | OHM 5% 1/4W |         |
| R2 | 40-27-1332 | FXD C FILM | 330    | OHM 5% 1/4W |         |
| R3 | 40-16-1561 | FXD C FILM | 560    | OHM 5% 1/6W | RD1/6FS |
| R4 | 40-16-1561 | FXD C FILM | 560    | OHM 5% 1/6W | RD1/6FS |

|            |           |             |            |
|------------|-----------|-------------|------------|
| REFERENCE  | KIKUSUI   |             |            |
| DESIGNATOR | PARTS NO. | DESCRIPTION | 97-11-0200 |

A22 ASSEMBLY

|     |            |               |        |               |         |       |           |
|-----|------------|---------------|--------|---------------|---------|-------|-----------|
| C1  | 52-98-1010 | FXD CER       | 1000PF | +80-20%       | 6.3KV   | TYPE1 |           |
| C2  | 52-98-1000 | FXD CER       | 4700PF | +80-20%       | 3.15KV  | TYPE1 |           |
| C3  | 52-98-1000 | FXD CER       | 4700PF | +80-20%       | 3.15KV  | TYPE1 |           |
| C4  | 52-98-1000 | FXD CER       | 4700PF | +80-20%       | 3.15KV  | TYPE1 |           |
| C5  | 52-98-1010 | FXD CER       | 1000PF | +80-20%       | 6.3KV   | TYPE1 |           |
| C6  | 52-98-1010 | FXD CER       | 1000PF | +80-20%       | 6.3KV   | TYPE1 |           |
| C7  | 52-98-1010 | FXD CER       | 1000PF | +80-20%       | 6.3KV   | TYPE1 |           |
| C8  | 52-98-1010 | FXD CER       | 1000PF | +80-20%       | 6.3KV   | TYPE1 |           |
| C9  | 52-98-1010 | FXD CER       | 1000PF | +80-20%       | 6.3KV   | TYPE1 |           |
| C10 | 52-98-1010 | FXD CER       | 1000PF | +80-20%       | 6.3KV   | TYPE1 |           |
| C11 | 52-98-1010 | FXD CER       | 1000PF | +80-20%       | 6.3KV   | TYPE1 |           |
| C12 | 52-03-3469 | FXD CER       | 0.01UF | +100-0%       | 500V    | TYPE2 |           |
| CR1 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| CR2 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| CR3 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| CR4 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| CR5 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| CR6 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| CR7 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| CR8 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| CR9 | 32-90-1951 | DIODE         | VR=6KV | FAST RECOVERY | SANKEN  |       | GHV-06SSN |
| R1  | 40-16-2101 | FXD C FILM    | 1K     | OHM 5%        | 1/6W    |       | RD1/6FS   |
| R2  | 40-37-6101 | FXD C FILM    | 10M    | OHM 5%        | 1/2W    |       |           |
| T1  | 63-92-0190 | SWITING TRANS | HV-6   |               | KIKUSUI |       | S8513932  |







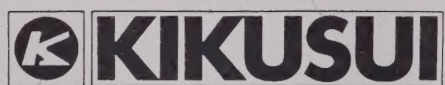
**KIKUSUI ELECTRONICS CORP.**

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3-1175, SHINMARUKO HIGASHI NAKAHARA-KU KAWASAKI-CITY, JAPAN

Telephone (044) 411-0111 9 Telex 3842678 KECJPN-J Cable address "KIKUSUIDE" KAWASAKI





 KIKUSUI ELECTRONICS CORP.

1-1-1, Higashi-Shinjyuku, Shinjyuku-Ku, Tokyo 162-8502, Japan  
Tel: 03-3346-1111 Fax: 03-3346-1112 E-mail: kikusui@kikusui.co.jp





